A USER-PERSPECTIVE APPROACH FOR THE DESIGN OF MODERN BILINGUAL AIRPORT SIGNAGE

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A USER-PERSPECTIVE APPROACH FOR THE DESIGN OF MODERN BILINGUAL AIRPORT SIGNAGE

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SUMMARY

According to Wiseman (1979), signage is one of the four environmental variables that are likely to affect wayfinding behavior, especially when speaking of large built environments like airport facilities. Airports have increased in size with the popularization of air travel and the emergence of new technology, which in turn has created less than ideal facility configurations for users' wayfinding purposes. For that reason, the primary tool used to move the traveling public through airport facilities is signage, which should employ a concise and comprehensible system of directional, identification, regulatory and informational messages (Erhart 2001) to help all airport users navigate the maze-like facilities.

With the intent of successfully directing the majority of airport users to their desired destinations, airport planners have implemented bilingual signage in several airports across the United States. The majority of these systems utilize Spanish as a secondary language: a reflection of the changes in population of American communities and the addition of new travel routes to Mexico, Central, and South America from several airlines.

Whereas the importance of having bilingual signage systems is apparent, there is little information concerning how the Spanish speaking user views these bilingual systems and whether they are useful. The purpose of this thesis is to shed light on this issue by conferring with the user on the usability of several features of bilingual (English-Spanish) signage systems, and involve them in the design process with the goal to develop a useful system. As a result of this thesis, recommendations for improving the design of English-Spanish signage systems will be provided.

The methodology used to collect data for this research study involved three phases, each with a particular purpose and outcome. The first phase consisted of an on-

line questionnaire with the purpose of collecting the opinions Spanish speaking users currently have regarding existing bilingual signage. The second phase also involved an on-line questionnaire. This time the questionnaire's objective was to identify the Spanish translations of airport terminology that are preferred by the potential user of this type of signage systems. Lastly, the third phase of the research consisted of performing an experiment to observe whether a set of graphic standards and Spanish message placement exist such that the Spanish message on bilingual signs is more understandable for the Spanish speaking user.

These experiments revealed that current U.S. airport bilingual signage, as experienced by Spanish speaking users, can be improved upon. Participants' assessment of terminology translations enabled the creation of a consolidated list of Spanish terms that account for user preference over a variety of alternate translations for each airport function. Finally, testing of graphic standards in the context of bilingual signs enabled the formulation of design recommendations that allow for the improvement of bilingual signage usability.

INTRODUCTION

Motivation

With the growing popularity of air travel and the introduction of new technology in airplanes as well as in ground facilities, airports have become larger and more complex. Architects and designers have been forced to develop new ways to improve existing airport facilities or to come up with entirely new designs to accommodate the changing industry. This increase in scale has not only created functional and operational challenges for airport employees, it has also created particular problems for airport users and/or travelers, such as wayfinding difficulties (Suther 1985).

In its most literal sense, wayfinding refers to the ability of a person to find his or her way in physical space and navigate to a given destination. In airports, wayfinding refers to the movement of users through a myriad of lobbies and corridors in order to catch an airplane, exit the facility after arriving from a trip, meet an arriving passenger, etc. In most cases these processes are complex, and they become even more so each time the path to a destination increases in length and/or the number of choice points where travelers are asked to make a decision on which way to go increases in number. In addition, the increased number of individuals moving through today's airports has created congestion throughout the existing facilities, especially at decision points resulting in increased disorientation and frustration for the traveling public. Anecdotal evidence suggests that wayfinding problems in large facilities, such as airports, may result in stress (Suther 1985), which coupled with increased security measures and longer lines at security checkpoints, create a challenging experience for any type of traveler.

The array of user types that transit the airport facilities encompasses domestic and foreign travelers. The domestic traveler type includes first-time users, sporadic users, frequent users, and a large number of users who utilize the facility as a transfer point between locations (connecting flights). The foreign traveler also include first time users, sporadic users, frequent users and connecting users, but a second level of differentiation exists. Foreign travelers are also subject to their ability to comprehend the local language. It is possible that a foreign traveler is fluent in the local language (oral and written); that he/she can speak the language but does not read it; that his/her knowledge of the language is limited, or that the foreign traveler does not comprehend the local language at all.

Having such a varied array of users, airport planners are faced with a big challenge when considering options to alleviate wayfinding difficulties. According to Wiseman (1979) there are four classes of environmental variables that are likely to influence the wayfinding behavior of users in large facilities such as airports:

1. **Plan Configuration**. Characteristics of the facility design which influence how easy it is to create a mental image of the building layout.
2. **Architectural Differentiation**. The degree to which there is a visual distinction between different areas of a building.
3. **Perceptual Access**. The capability to see through or out of a building as a means of orientation.
4. **Signage**. The most common direction and wayfinding aids within complex built environments.

The first three variables, plan configuration, architectural differentiation and perceptual access, are rigid resources which are difficult, expensive and inconvenient to modify. It is then the importance of signage moves to the forefront. Signage systems are the primary tool used to move the traveling public through airport facilities using a

concise and comprehensible system of directional, identification, regulatory and informational messages (Erhart 2001). They are a pliable tool that changes with the needs of the airport, be it that the airport has grown in size; that airport functions within it have changed location, or that cultural and political factors have created a change in the mix of the traveling public.

In today's airports, it is not strange to find bilingual signage systems. In most cases, these bilingual signage systems come about as a response to the increase of foreign travelers as well as changes in the population of the community in which the airports are located. The most common language being implemented today in bilingual signage systems in the United States is Spanish. This is not surprising for two reasons:

1. According to the U. S. Census Bureau's annual population estimates released on August 4th, 2006, 42 million people out of the 296 million people living in the United States are of Hispanic origin and consider Spanish their primary or secondary language. This is the second largest population group in the U.S. (Bernstein 2006).
2. Major U. S. airlines carry direct and connecting flights to Mexico, Central and South America and are projected to keep growing in those markets, increasing the number of airport users, traveling to and from the United States whose primary language is Spanish and whose knowledge of English is limited. Delta Airlines alone, has 400 weekly flights to 48 Latin American destinations and is on track to become the second-largest carrier in the region (Delta 2007).

The implementation of English-Spanish signage systems has come about as a customer service response from U. S. airports to the increase of Spanish speaking travelers; however the usability of these bilingual systems has yet to be studied.

Whereas the importance of having bilingual signage systems is apparent, there is little information concerning how the Spanish speaking user views these bilingual systems and whether they are useful. The purpose of this thesis is to shed light on this issue by conferring with the user on the usability of several features of bilingual (English-Spanish) signage systems, and involve them in the design process with the goal to develop a useful system. As a result of this thesis, suggestions for standardizing the design of English-Spanish signage systems will be proposed.

How to Read This Thesis

This thesis provides a look into the usability of bilingual signage systems. The study of existing bilingual signage systems from the users' point of view was approached in four steps:

1. First, a literature review encompassing the principles of wayfinding, the existing Guidelines for Airport Signing and Graphics, and Spanish language and translations, provided a background for the research and an approach to the methodology.
2. To gain insight into the opinion of the users regarding the usefulness of existing bilingual signage systems, a 15 question survey was created and was distributed to 45 individuals who's primarily language is Spanish and who are not English proficient. The survey was intended to gather opinions on the signage's helpfulness in navigating the airports as well as its quality of messaging.
3. A second questionnaire was distributed to gather the Spanish translations of airport functions that users identify as being the correct translations. The terminology tested in the questionnaire was obtained by compiling and comparing the approved translation lists used in US airports through which

large numbers of Spanish speaking users travel, or US airports located in areas with large Hispanic populations. The translation lists used for this study were taken from: Miami International Airport, Hartsfield-Jackson Atlanta International Airport, the Houston Airport Authority and the Port Authority for New York and New Jersey.

4. Lastly, a design exercise was conducted in order to obtain first hand input from potential users on aspects that would make a bilingual signage system useful. The exercise was followed by a feedback session in which the participants were encouraged to share their comments and opinions regarding the signage.

BACKGROUND

Introduction

The following section recaps the information that was gathered from the literature review. It addresses the principles of wayfinding, defines the term, and explains how the wayfinding process works. The existing Guidelines for Airport Signing and Graphics, and Spanish terminology in airports, provide a starting point for the evaluation of the signage systems currently implemented. Also included are definitions of terminology that will be used throughout the rest of the research as well as references to pertinent appendices whenever necessary.

Principles of Wayfinding

The term wayfinding appeared in the late 1970s replacing the term "spatial orientation." It offered a new approach to studying people's movements and their relationship to space, but most importantly, it opened up new ways to design for people's spatial behavior (Carpenter 1989). The term was introduced to describe the process people go through in order to reach a familiar or unfamiliar destination. According to Arthur and Passini (1992) wayfinding is best defined as spatial problem solving, and it is comprised of three specific but interrelated processes:

1. **Decision making** and the development of a plan of action.
2. **Decision execution** transforms the plan of action into the correct behavior at the right place in space.
3. **Information processing** encompasses environmental perception and cognition and is in turn responsible for the two decision-related processes.

Decision Making

For wayfinding, the decisions that are of interest are those that have to be taken in order to reach a certain destination. These decisions comprise the plan of action that is to be followed, and according to Arthur and Passini (1992), they are structured and hierarchical. The most general decisions are located at the left of the decision plan while the decisions that lead directly to action are located at the right, as it is described in the example by Arthur and Passini found in Figure 1.

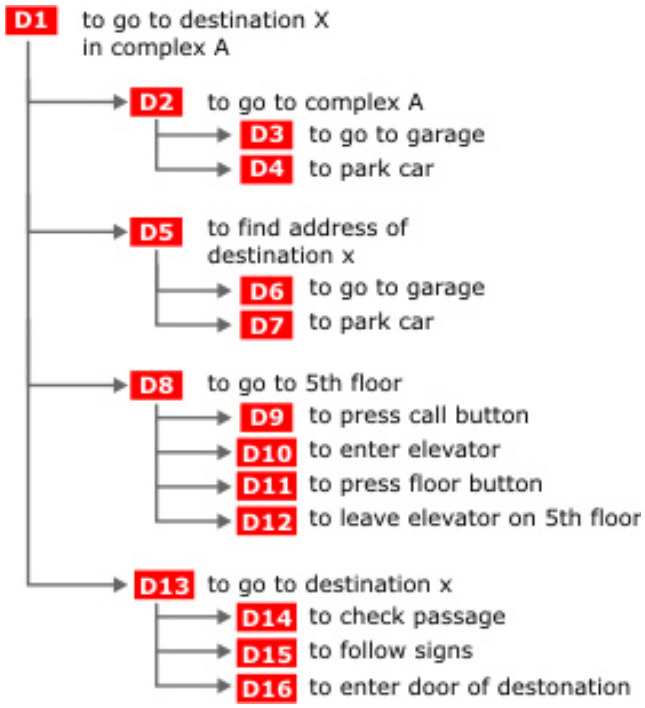


Figure 1: Decision Diagram (Arthur and Passini 1992)

It is also important to mention that wayfinding decisions are taken as the individual moves through the environment not prior; hence the availability of environmental information is crucial to wayfinding decision making. It is possible that at some point along the route limited, contradictory or no information is encountered. This situation would force the individual to resort to trial-and-error, chance or instinct to continue through the route (Arthur and Passini 1992).

Decision Execution

Having a mental plan on how to reach a destination is necessary, but in order to reach the desired location each decision this plan is comprised of must be transformed into the right behavior at the right place. Turning left and right is not enough; the individual must turn at the correct juncture, or choose to veer right at the correct fork in the road. When executing a decision the immediate environment is matched to a mental image created beforehand (Arthur and Passini 1992). For example, if the correct intersection, stair, landmark, etc. is found, the behavioral part of the decision is executed, and then, the individual starts looking for the next indicator to execute the next behavior.

Information Processing

Perception and cognition are the two components of information processing. Perception is the process of gathering information through the senses, and cognition refers to understanding and being able to use the information being perceived (Arthur and Passini 1992).

Environmental perception starts with the mechanisms of scanning and glancing. When moving through a complex environment, the eyes scan the visual field to identify objects or messages of interest (Neisser 1967). These messages are then focused upon and held in short-term memory. As expected, a person looking for a destination cannot take in every message; instead the useful information must be deciphered from among all the clues available. Information that is not directly relevant tends not to be seen even if it will become relevant sometime later. With this in mind, it is fair to say that information at the wrong place is just as good as not having information at all. The location of information is a crucial issue.

Environmental perception is not only limited to sight, but it is the most efficient way to identify information from an environment when making a wayfinding decision. Visual scanning is fast, efficient and reliable (Arthur and Passini 1992), and it works at a distance and close-up. Distance sight can be the most important type of sight when speaking of the wayfinding process, since it allows people to direct themselves towards a distant reference and prepare for the next decision well in advance of reaching the decision point.

Understanding the information being perceived is the second part of information processing. Environmental cognition starts with the knowledge people have about the given environment, in other words what they remember about a particular setting (Arthur and Passini 1992). According to Evans, Smith and Pezdek (1982), there are four factors that increase the possibility of remembering a piece of information in an environment:

1. The **form** in which the information is presented. Its size, color, shape, style.
2. The **visibility** and **accessibility** to the information. From how far it is visible, and how easy it is to distinguish in the environment.
3. The **usefulness** of the information. How much does the information help the decision making process?
4. The information's **symbolic significance**. Is there a historical or personal meaning that can be attached to the piece of information that will make it easier to remember?

Based on what a person remembers of the environment, a mental image is created. This mental image is called a cognitive map. The term was first introduced by psychologist E. C. Tolman (1948) to explain how rats learned the locations of rewards in a maze (Sommer and Sommer 2002). Cognitive maps can be very different from the actual environment since information that is not useful or important tends to be

omitted from the mental model. They also tend to be very different from person to person since the perception of the environment varies greatly among individuals. That is, not everyone finds the same information important and useful. However, researchers have been able to make a distinction between two types of cognitive mapping, which research has shown coexist even if they contain contradictory information (Arthur and Passini 1992):

1. A mental map may be structured in terms of routes; mainly taking into account the points where there is a direction change.
2. A mental map may be structured in terms of topographical relationships, where the important information tends to be the location of landmarks.

One thing is to have a mental representation of an environment; manipulating it so that it can be used to solve wayfinding problems is quite another. Passini, Proulx and Rainville (1990), in their study of the spatio-cognitive abilities of the visually impaired, identified basic wayfinding tasks and determined the manipulation necessary solve wayfinding problems. From their study, seven distinctive tasks and corresponding manipulations surfaced as crucial for wayfinding. They are shown in Figure 2 .

Basic Wayfinding Task	Corresponding spatio-cognitive manipulation
Learning a new route	Recording a decision plan and/or developing a cognitive map
Returning to the point of origin (retracing one's steps)	Inverting a decision plan or the mapped route
Linking known routes to new configurations	Combining decision plans or sections of mapped routes in new combinations
Learning a route from a small display and making the journey	Making a transfer of scale
Pointing to the directions of locations visited on a journey	Making a triangulation
Learning a route from a non-aligned display	Making a mental rotation
Understanding the overal layout of a visited setting	Identifying the underlying principle of spatial organization

Figure 2: Spatio-Cognitive Manipulation (Passini et al. 1990)

This overview of wayfinding illustrates the complexity of the process. People are skilled at spatial problem solving; however, people get lost in the built environment quite often. These wayfinding difficulties are usually due to particular features of the environment that are complex, not clear or do not offer the correct information for the success of the wayfinding process.

Guidelines for Airport Signing and Graphics

"The design of an information system has to be based on people's wayfinding behavior. It must contain all the necessary information for them to execute decisions along a given route. In addition, it must provide the information necessary for gaining a representation of a setting." (Arthur and Passini 1992).

During the 1960s and the mid 1970s, there was relative stability in the aviation industry regarding which airlines served which airports. As a result the signage systems designed during this period experienced little changes allowing for the use of expensive and durable materials. All of this changed when on October 24th, 1978 President Carter signed the Airline Deregulation Act. Airlines now had the ability to test markets and move in and out of airports with ease. It also became common for airlines to change locations within the airports, mostly due to market growth or airport expansions (Erhart 2001). It is fair to assume that these continuous changes resulted in high costs for the industry and significant confusion for airport users.

In March 1982, a joint industry Airport Signing and Graphics Task Force was created with the purpose of rectifying the problems caused by the constant changes within airports. It was comprised of representatives from the Air Transport Association of America (ATA), American Association of Airport Executives (AAAE), and the Airports Council International – North America (ACI-NA), whose purpose was to develop material that would inform airport operators, airlines and consultants of economical

and practical signing methods. The taskforce also received input from design professionals who provided invaluable assistance in order to make the recommendations more comprehensive and authoritative. Some of the professionals involved were: sign manufacturers, the Society of Environmental Graphics Design (SEGD), the American Institute of Graphic Arts (AIGA), the Institute of Transportation Engineers (ITE), the Federal Aviation Administration (FAA), and the Civil Aeronautics Board (CAB) (Erhart 2001).

The product from the two year collaboration is a publication called the *Guidelines for Airport Signing and Graphics: Terminals and Landside*, which was first published in 1984. It has undergone three revisions, the latest one in 2001, and it has become an important source of guidelines and design criteria for the development of practical, functional and flexible airport signing and graphics systems.

The following sections broadly summarizes some of the design principles and guidelines design professionals use as reference for terminology, graphic standards, and other elements critical in developing a sign system.

Signing Philosophy

Signing systems must be designed with the objective of developing a concise and objective set of messages which will aid the majority of users. According to Erhart (2001) there are three major categories of messages that are used to communicate the pertinent information to the user. These are:

1. **Directional**. It is considered the most important type of sign in an airport complex. Proper directional signing is essential because the movement of vehicles and people through the airport is characteristically rapid compared to other environments. In addition to traditional signing considerations for the conventional passenger, directional signing is vital to those persons

arriving late for a flight, persons with disabilities, foreign visitors, non-English speaking passengers, and those passengers experiencing disorientation.

2. **Informational**. It is secondary and much less important than directional signage, providing specific details about airport services and functions such as restaurants, restrooms, telephones, gift shops, etc. The most common example of this type of signage is the directory maps located throughout airports' terminals and concourses.
3. **Identification, Regulatory and Advertising**. These signs move to a tertiary level of priority. Identification signs mark the location of airport functions in a visible and accessible manner. Regulatory signs relate to local, state and federal requirements such as traffic signs, FAA message boards, no smoking signs, etc. Advertising signs reflect promotional needs of business, as well as a source of revenue for the airport.

A list of airport functions that need to be addressed in an airport's signage systems extracted from the *Guidelines for Airport Signing and Graphics: Terminals and Landside* can be found in Appendix A1.

Standard Terminology

Terminology, as it applies to airport wayfinding and signage, is a set of words, syntax, grammar, spelling, and symbols used to communicate information to the user. In order to present airport signing in a concise manner, it is necessary to use a consistent and clear terminology throughout the signage system (Erhart 2001). A list of the terms firmly requested and suggested as standards for a uniform national airport signage program in the *Guidelines for Airport Signing and Graphics: Terminals and Landside* are located in Appendix A2.

Not all airports function exactly the same way. Therefore, the terminology sometimes needs to be adjusted to reflect the airports' unique features. There are seven objectives that should be applied to the development of a final airport terminology list (Roberts 2006).

1. **Consistency**. The names of parts of the buildings, the names of functions and the descriptions of airport process should be the same throughout the signage system in order to avoid the potential confusion that using alternate terms can create for the user.
2. **Common Usage**. The terms used in signage systems must be written in everyday language so that they are easy to understand by people who are not familiar with the technical functions of the airport.
3. **Grammar and Spelling**. The signage systems should observe all grammar and spelling rules. Nouns should represent places; verbs should represent actions or process, etc.
4. **Punctuation**. The use of capital letters, hyphens, slashes, dashes, apostrophes and all other punctuation rules should be observed. For some notations, simplified punctuation is permitted, as long as it is correct punctuation.
5. **Symbols and Words**. Symbols are most effective when supported by clear understandable words.
6. **National Standards**. Terminology used in the signage system should be consistent most of the time with the terminology used in signage systems of similar facilities across the country. Only some regional exceptions are accepted.
7. **Comprehensive System**. The signage system must address all places and functions of the airport facility that are open to the user.

Message Hierarchy

A uniform hierarchy of messages and information should be established throughout the airport complex. Clear logical hierarchies must exist to help users remember and use the terminology (Roberts 2006). Messages should be categorized into three succinct categories (Erhart 2001):

1. **Primary**. The information should be the largest and most visible on any given sign face.
2. **Secondary**. This information supplements or reinforces information previously conveyed by the primary message.
3. **Tertiary**. Supplements both the primary and secondary messages and is usually intended to inform visitors of regulations and warnings.

For an example list from the *Guidelines for Airport Signing and Graphics: Terminals and Landside* that includes the sign messages that should be included in each category of messages, see Appendix A3.

It is important to understand that the message may fall under a different category depending on its use. For example, a passenger that has just deplaned would find restroom signage in the primary category. However, for a passenger that has just arrived to the airport, the same message becomes secondary.

In general, emphasis should be placed on reducing the number of signs and sign content where possible, since more than three messages in a directional sign tend to be overwhelming for the user. Additionally, the sign system should move from general to more specific terminology as a passenger traverses the facility (Erhart 2001).

Typography

The importance of an effective letter style for airport signing cannot be overemphasized (Erhart 2001). It is recommended that airport signing systems use a consistent, similar typographic letter style from the same basic type family through the entire facility. The four type families recommended for aviation oriented projects are: Helvetica, Frutiger, Univers and Futura.

Word and Line Spacing

According to Erhart, word spacing between related words is normally three quarters (.75) times the capital letter height, as shown in Figure 3.

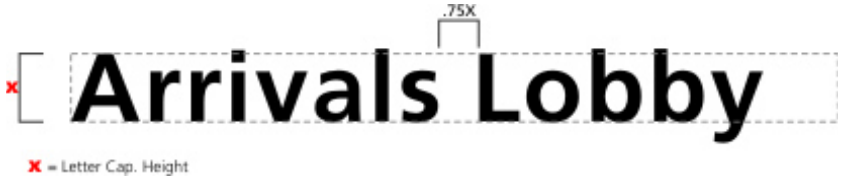


Figure 3: Typical Word Spacing (Erhart 2001)

Line spacing should be one half (.50) times the capital letter height for words of a related message line. Spacing between non-related message lines should be 1 times the capital letter height. This is illustrated in Figure 4.

Figure 4: Typical Line Spacing (Erhart 2001)

Color

Many considerations must be made with multi-colored sign systems, particularly with complex facilities and garage structures. Approximately 12% of the population is color-blind and cannot distinguish between mixed shades of red and orange, yellow and brown, or black and blue (Kokotailo, 2006). For this reason, if multiple colors are used it may be necessary to spell out the name of the color on the sign to make it clear to many of these individuals, which is not ideal for airport signage systems. Color codes are useful as supplements to a good linguistic format, and as such, should not be the primary means of distinguishing parts of an airport complex. Nonetheless, color as language can be an effective supporting player in any sign system. (Erhart 2001).

Arrows and Symbols

Arrows require less layout space than messages to convey a directional message, and are a lot more flexible when it comes to location in the layout (Erhart 2001). The same arrow graphic proportions should always be applied across the entire airport signage system to maintain consistency. The proportions of a typical arrow are illustrated in Figure 5. Also, careful design and review of sign layout must be done in order to produce proper positioning between arrows, messages, symbols and sign panel dimensions. Erhart's recommendations regarding arrow proportions and sizing relationships are illustrated in Figure 5 and Figure 6.

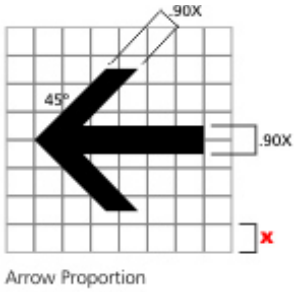


Figure 5: Arrow Proportion (Erhart 2001)

Figure 6: Arrow Sizing Relationships (Erhart 2001)

The angle of orientation and directional information that arrows intend to convey is of equal importance. Figure 7 illustrates the correct arrow orientation angles.

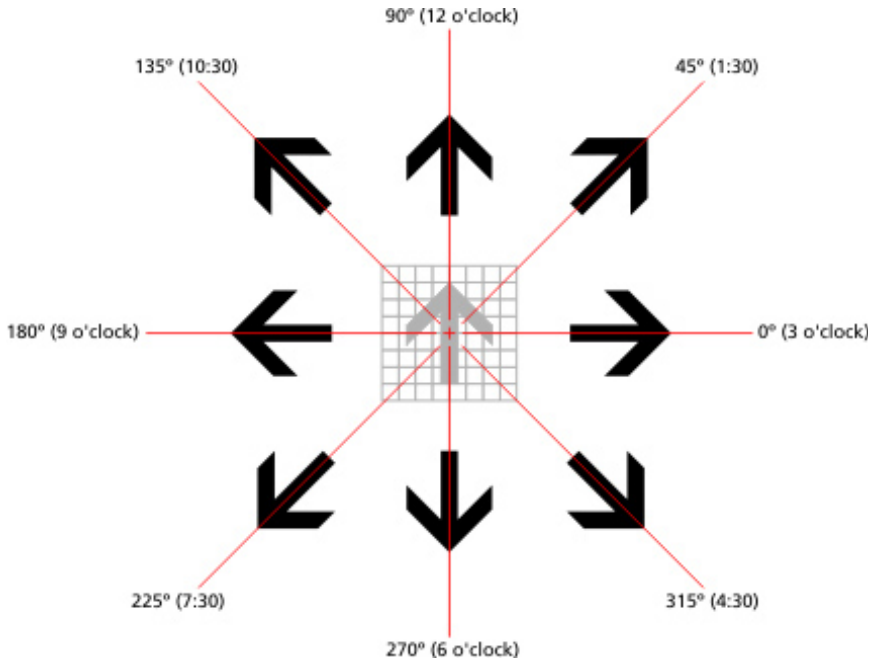


Figure 7: Arrow Orientation and Orientation Angles (Erhart 2001)

The American Institute of Graphic Arts (AIGA), under contract to the U. S. department of transportation (DOT), established a committee which embarked on a project to develop one international symbol system that would be graphically consistent and could be adopted world wide. Today there are more than 46 recognizable symbols available and additional symbols are being developed as new

airport functions like Self-Check-In require appropriate signage as they become more popular (Erhart 2001). A partial list of these symbols covering the most used symbols in today's airport signage systems can be found in Appendix A5.

Foreign Language Translations

Translations should be different from, but not subordinate to, the English message. The same lettering style can be used for both, but then they can be presented in different color, text weights, and copy height, and positioned in a manner that clearly separates them from the English (Erhart 2001).

Viewing Distances and Copy Size

Signage systems need to clear for a wide range of individuals including those with impaired ability ranges. In addition, general viewing conditions often will be less than perfect. Consequently, the proposed viewing distances are conservative. Erhart (2001) proposes that for every 25 feet of viewing distance, the capital letter of a message in a signs increases one inch. Thus, at a distance of 150 feet, a six inch capital letter and its associated lower case letters should be used for easier recognition. It is recommended to test a mock-up of the sign under actual or simulated field conditions to determine the correct type size for the environment, since the interior design, vertical clearances, clear horizontal viewing distances, and message requirements have a significant impact on copy height (Arthur and Passini 1992). The chart in Figure 8 shows rough recommendations for copy height in pedestrian signage (Erhart 2001). In it, it is also marked the ADA recommended capital letter height for compliance.

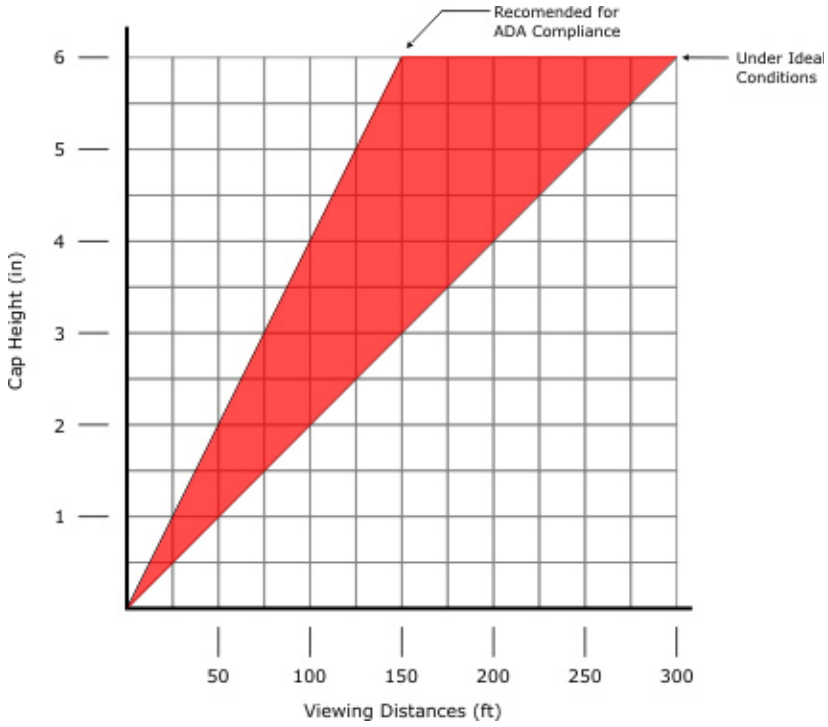


Figure 8: Pedestrian Viewing Distances and Copy Size (Erhart 2001)

Viewing distances for vehicular signage are a bit more complicated. It is necessary to take into account the speed of the vehicle, the number of lanes or the road, and the average reaction time of a motorist. For this reason, many airports insist on the use of standard state and federal guidelines (DOT) for exterior roadway signage (Erhart 2001). More information on viewing distances can be found in Appendix A6.

Spanish Language and Translations

Recent Census reports show that the U.S. Hispanic population has experienced an upsurge since the early 1990's. However, it is important to mention that Hispanic communities and varieties of the Spanish language have been present in the United States for well more than four centuries. In fact, Spanish actually antedates English in the areas that now make Texas, Nevada, Arizona, California, Colorado, and New Mexico (Carter 2005).

At the present time, the Spanish language in the United States is being impacted by the immigration of Hispanics from Cuba, Mexico, Puerto Rico, the Dominican Republic, and Central & South American countries. Every state in the United States is now being affected by their growing Spanish-speaking populations (ADNET 2001). The Pew Hispanic Center tabulated the percent Hispanic populations for each state in the United States in 2005. The tabulations are based on the 2005 Household Population numbers collected by the US Census Bureau's 2005 American Community Survey public use microdata file, released August 29th 2006. Although the household population is the bulk of the total population of each state, it does not include persons residing in group quarters like dormitories, correctional facilities, and nursing homes (Hakimzadeh and Fry 2006). The breakdown is illustrated in the Figure 9.

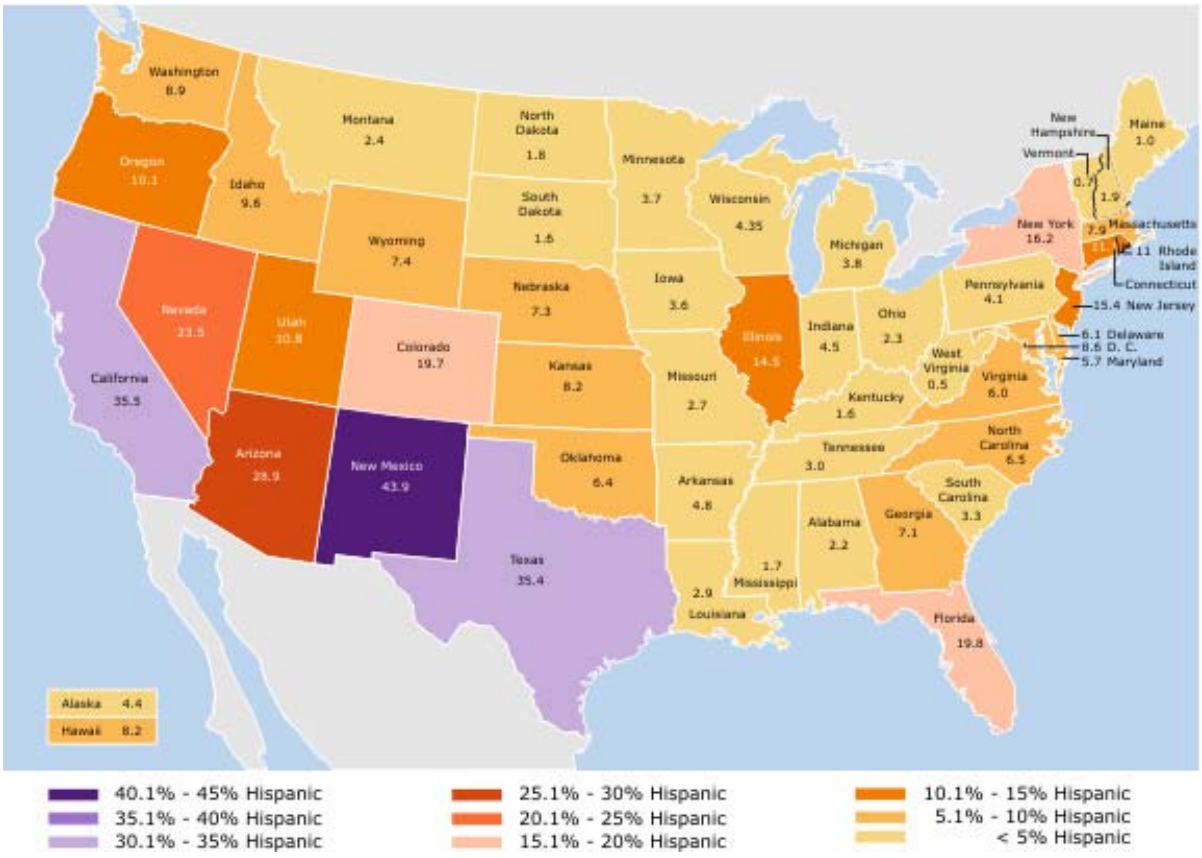


Figure 9: Hispanic Population by State: 2005 (Hakimzadeh and Fry 2006)

The areas with higher percentage of Hispanic population are located in the Southwestern states of the country, specifically the states of New Mexico, California, Texas and Arizona. It is important to mention that other states have also recorded great increases in the number of Hispanics living in their populations (Hakimzadeh and Fry 2006). An example of this increase is the state of Illinois.

Unsurprisingly, the five states that showed the largest increases in Hispanic populations in the last five years are California, Texas, Florida, Arizona, New York, and Illinois. These percentages include new immigrants (foreign born Hispanics) as well as descendants from immigrants that previously settled in those states (native born Hispanics) (Hakimzadeh and Fry 2006). The numbers of these statistics are illustrated in Table 1.

Table 1: Hispanic Population 2000 and 2005 (Hakimzadeh and Fry 2006)

	2000	2005	Change 2000 - 2005	Percent Change 2000 - 2005
California	10,741,711	12,534,628	1,792,917	16.7
Texas	6,530,459	7,882,254	1,351,795	20.7
Florida	2,623,787	3,433,355	809,568	30.9
Arizona	1,267,777	1,679,116	411,339	32.4
New York	2,782,504	3,026,286	243,782	8.8
Illinois	1,509,763	1,807,908	298,145	19.7

For detailed information on percent population changes in the United States from 2000 to 2005, as well as for the make-up of the Hispanic populations (detailed Hispanic origin) please refer to the tables in Appendix B.

In terms of the airline industry, this increase of Spanish speaking communities coupled with the increased number of air travel routes to Latin America and the Caribbean, has created a need for the design and implementation of English-Spanish signage systems to ensure that wayfinding works for the majority of the airport users. The design of these bilingual signage systems is being achieved by following the existing *Guidelines for Airport Signing and Graphics*. However, recurrent questions

regarding the correct airport terminology translations often arise: Which form of Spanish should be used to translate (Mexican, Colombian, Cuban, etc,)? Which Spanish translation is the correct one? How is the decision to be made? (Roberts 2006).

From the nature of these questions it is noticeable that many Americans are under the impression that there are vast differences between Spanish language dialects that would impede effective communication. This is not more true for Spanish than it is for English (Erichsen 2007). While the comparison isn't completely accurate, the differences between the Spanish dialects are something like the differences between British English, Australian English, and American English. People throughout the Spanish-speaking world can communicate with each other as easily as people throughout the English-speaking world can.

This inter-communication is possible due to the existence of a core language, common to all Spanish varieties, which is called standard Spanish. Each country, many regions, and even specific neighborhoods have developed varieties of Spanish, which differ to a greater or lesser extent from Standard Spanish, but normally, every Spanish-speaking person will also speak standard Spanish. This double linguistic level helps explain why, while it is possible to identify dozens even hundreds of Spanish language varieties, the basic unity of the language is preserved. Thus translations can be made in standard Spanish, avoiding colloquialisms but adjusted to the needs of the users. (Cabanellas de las Cuevas 2003).

When speaking of airport terminology, the difference between Spanish variations is more evident in certain terms. The majority of airport terms can be translated into standard Spanish. However, it is possible to adjust some of them according to the preferred word choice (synonyms) of the population that comprises the main users of the signage system. For example, the English term **elevator** may be translated as **elevador** or **ascensor**. Choosing either of these synonym words as the

Spanish translation for the signage system is correct. The key in translating is to keep in mind to avoid the use of colloquialisms, and Anglicisms, which are not correct Spanish and tend to confuse and upset Spanish speakers.

A compilation of approved translation lists currently in use in US airports catering to large numbers of Spanish speaking users can be found in Appendix C. The following airports comprise the list: Miami International Airport, Hartsfield-Jackson Atlanta International Airport, the Houston Airport Authority, and the Port Authority for New York and New Jersey.

RESEARCH QUESTIONS AND HYPOTHESES

Introduction

Several questions regarding English-Spanish bilingual airport signage were raised during the initial information gathering phase which later became central elements for the framework of this thesis. They brought to the forefront the areas of bilingual airport signage that warranted further exploration. These questions, their importance to the study, and the hypotheses that were derived are discussed in this chapter.

Research Questions

This thesis is concerned with the user perspective of bilingual (English-Spanish) sign systems in US airports; therefore, it essential to take a look at how the users view this type of signage. The first questions that need to be answered for this research are:

- What is the opinion of the Spanish speaker regarding the quality of the signage (visibility of the Spanish message; readability of the Spanish message; understandability of the translated terms, etc.)?
- Does the intended Spanish speaking user actually utilize the Spanish messaging on the bilingual signs?
- Do Spanish speaking users find the Spanish messaging useful?

It is also important to take a look at the form in which information is presented to the user because it may influence greatly the user's perception of the signage, and how useful it is for them. This proposes the following signage features as areas of interest for this research:

1. Spanish translations of airport terminology

2. Positioning on the sign of Spanish messaging
3. Graphic standards applied to Spanish messaging
    a. Color
    b. Text weight
    c. Copy height

As mentioned in the previous chapter, Spanish translations of airport functions are a point of controversy for designers, as well as for US airports. There does not seem to be a consensus on how to translate airport terminology into Spanish. This lack of standards raises the following research questions:

- Do the translations currently in use on airport bilingual signage really vary that much from one another? If they do, which translations of airport functions vary the most?
- Are there Spanish translations of airport terminology that are favored over synonym translations by the majority of Spanish speakers? If so, what are those favored terms?
- Is it possible to create a consolidated list of recommended translations that can be used as a primary guide for the design of English-Spanish bilingual airport signage?

Regarding the positioning and graphic standards of the Spanish translation on the sign and the graphic standards applied to it there seem to be two typical design approaches. Spanish translations are placed on bilingual signage as secondary messaging. They are most commonly placed either right underneath the primary message (English message) in a smaller copy size and in the same color of the primary message, or in a separate area of the sign, once again in a smaller copy size and the

same color of the primary message. See Figure 10. These typical "sign templates" follow the existing design guidelines proposed by Erhart (2001).

Approach A

Approach B

Figure 10: Typical Design Approaches

The questions that this research will address regarding Spanish message positioning and graphic standards are:

- Does one of the typical "sign templates" make the Spanish translation easier to understand than the other templates? If so, which one?
- Does varying the color and text height of the Spanish translation make the bilingual sign easier to understand for the Spanish speaking user?
- Is there a combination of translation position and graphic standards that make the bilingual sign more usable for the Spanish speaker?

Hypotheses

With the help of the research questions discussed previously, three hypotheses took shape to drive the research. These statements are:

Hypothesis #1: **English-Spanish bilingual airport signage currently in use in U.S. airports is perceived by the Spanish speaker users as a necessity, but its current design and content is not perceived as useful by the users.**

Hypothesis #2: **There are Spanish translations of airport terminology that are favored over alternate translations by a majority of Spanish speakers. A consolidated list of recommended translations favored by user preference can be produced.**

Hypothesis #3: **There exists a combination of graphic standards and message placement perceived to be more useful over other similar combinations by the Spanish speaking user.**

To prove or disprove these hypotheses, three phases of experimentation were developed, and will be explained in depth in Chapter 4 (Approach and Methodology).

APROACH AND METHODOLOGY

Introduction

The researcher strived to use a large number of subjects in this research study in order to allow for a greater validity of the results. In order to get a wide range of responses and opinions, the subjects that participated in the study included men and women of different Hispanic backgrounds, of different age groups, of different educational levels, and with different levels of English proficiency. The process employed for the collection of data provided user opinions and observations regarding bilingual (English-Spanish) signage in U. S. airports. This process was comprised of three phases of information gathering, each with a particular purpose and outcome.

Phase I:

The objective of this phase of experimentation, intended to test Hypothesis #1, was to obtain opinions and observations of Spanish speaking airport users regarding existing bilingual (English-Spanish) airport signage.

The most straightforward way to prove or disprove this hypothesis would have been to consult previously implemented user surveys and/or experiments, but statistics and/or reports that illustrate what the users think about these signs and whether they use them or not were not publicly available. Therefore, a survey to obtain theses opinions and observations was created by the researcher.

The subject pool for this first phase of experimentation was constrained to Spanish speaking airport users with Limited English Proficiency (LEP). This constraint was applied in order to obtain observations and opinions from the primary users of bilingual (English-Spanish) airport signage. The assumption is that if an airport user knows English, he or she will most likely use their knowledge of said language as an aid

to navigate airport facilities and may not have the need to pay attention to the Spanish messaging on the sign.

For this reason, the fifteen (15) question on-line survey crated to obtain the opinions and observations of the primary users of bilingual (English-Spanish) airport was translated into Spanish and distributed among LEP potential participants only. Finding individuals that meet the LEP criteria was a challenge; therefore, a word of mouth strategy of recruitment was implemented. Potential participants known to the researcher to meet the language criteria were asked to answer the questionnaire which was distributed via an e-mail invitation. They were in turn asked to forward the invitation to other potential participants that they knew met the LEP criteria and so on. This method of recruitment also helped maintain the anonymity and confidentiality of the participants. Hard copies of the survey can be found in Appendices D1 (English) and D2 (Spanish).

The survey was open to collect responses for 60 days. It was available to Spanish speaking users who reside in the United States, as well as among users from other Spanish speaking countries who travel to the United States for business or pleasure. The users surveyed ranged in nationality, age, and education level.

Phase II:

The first step to prove or disprove Hypothesis #2 was to compile into a comparison table (Appendix C) the Spanish translations currently in use in U. S. airports that cater to a large number of Spanish speaking users or are located in areas with a largely Hispanic population. The translations compiled are currently in use in the following airports: Hartsfield-Jackson Atlanta International Airport, Houston Airport Systems, Miami International Airport and the Port Authority of New York and New Jersey Airports.

Once the airport translations table was created, it was determined that a second on-line survey to identify the user preferred Spanish terminology for key airport functions would be an appropriate approach to test the hypothesis. For this survey it was no longer necessary to constraint the subject pool to LEP Spanish speakers. On the contrary, for this phase the participants were required to understand the current airport terminology in English. The invitation to participate was once again made via an e-mail invitation, which was distributed among the bilingual airport users known to the researcher. In an effort to reach as many potential participants as possible, the potential participants e-mailed were also encouraged to spread the invitation to other bilingual individuals, in a sense creating, once again a word of mouth invitation process.

The on-line questionnaire was developed using the comparison table of Spanish translations as a guide. Eleven (11) terms in this table were found to have consistent translations across all of the approved translation lists. These particular terms were also found not to have alternate translations as there is a one to one correspondence between the English and the Spanish terminology. These terms can be found in Appendix C.

For the terminology that was translated differently in each of the researched airports multiple choice questions were developed in which the Spanish speaking users were asked to choose the translation that best described each airport function in question. In contrast for the terminology whose Spanish translations only varied very little from airport to airport the participants were asked to agree or disagree with the Spanish term currently used in the majority of U. S. airports. If they did not agree, they were then asked to propose a "better" way to translate the term. A hard copy of the questionnaire can be found in Appendix E1. The on-line survey was open to collect responses for 45 days with the intent to capture as much data as possible.

Phase III:

This last phase of research had as objective to observe whether a set of graphic standards exists such that the Spanish message on bilingual signs is more understandable and legible for Spanish speaking users, thus proving or disproving Hypothesis #3.

The participants for this experimentation phase were bilingual (English-Spanish) individuals of varying age, gender and nationality, whose first language is Spanish and have a high level of English proficiency.

The study consisted of showing participants presentation slides containing images of sample directional bilingual signage. For each of the slides, the participants were asked to note in their individual answer sheets the direction in which they would choose to go if they were tying to reach the airport function indicated by the researcher. The destinations were previously chosen by the researcher from the options on each of the sample signs created. Every time the experiment was performed, the same destination was indicated in each corresponding slide. An important feature of the signs developed is that, in order to ensure that the participants only read the Spanish message, the letters in the English message were scrambled and used as place holders. These unintelligible words were graphically treated as the English message would be to simulate bilingual signage.

To emulate the experience of traveling through a U. S. airport the experiment was conducted in English, this way immersing the participant in an English speaking environment where they would have to make the connection between their own Spanish translations of the airport functions and the translations presented on the signs. Also, each slide was shown for only seven (7) seconds to simulate walking through an airport and the quick decisions that need to be made in such situations.

The presentation was composed of thirty (30) slides, each showing a different sample directional sign. The sample signs were designed to be overhead, three directional signs, with separate message and arrow panels. Each message panel was designed to hold two levels of messaging. The color chosen for the signs' background was dark blue and the color used for the primary messaging was white in order to maintain the high contrast recommended for high legibility. The general layout of the signs is shown in Figure 11.

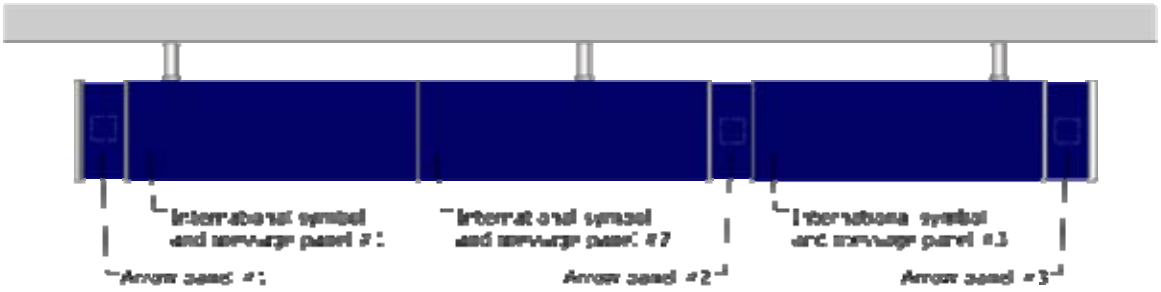


Figure 11: Basic Sign Layout

Using this basic sign layout, ten (10) slightly different messaging templates were created encompassing variations in the applications of text size, secondary message text color, message placements and presence/absence of an accent color. Examples of these ten (10) templates can be found in Appendix F1. Each template was utilized three times, creating the thirty (30) signs shown in the presentation. The complete set of presentation slides can be found in Appendix F2, and the answer sheet distributed to the participants in Appendix F3.

It was decided to conduct the exercise in a group setting in order to obtain as many responses as possible in a short period of time. After the slide exercise, the participants were encouraged to share their thoughts and opinions regarding the different signs shown. They were encouraged to make comments regarding the color, size and placement of the Spanish translations.

RESULTS AND ANALYSIS

Introduction

This chapter contains the results obtained from the three phases of experimentation as well as an analysis and discussion of the data gathered. This analysis brings insight into the significance of the data and how it can be useful for designers when creating bilingual airport signage. Some preliminary recommendations for design also start to appear with the analysis of the data, and will later be expanded and finalized in Chapter 6 (Conclusions and Recommendations).

Phase I:

The results of the survey were insightful concerning the opinions and observations of Spanish speaking airport users regarding existing bilingual (English-Spanish) airport signage. Thirty six (36) Limited English Proficiency (LEP) Spanish speakers between the ages of twenty two (22) and sixty eight (68) participated in the on-line questionnaire. These participants represent a cross section of Spanish speaking users that move through U. S. airport facilities, ranging from sporadic users who travel only one (1) or two (2) times per year, to frequent users, who travel through these facilities six (6) or more times per year. In this case, 42% of participants indicated that they travel sporadically (1 or 2 times per year), 28% said they travel often (3 to 5 times per year) and 31% indicated they travel very often (6 or more times per year).

A total of 94% of these participants said that they use signs as aids in finding their way through airport facilities, but only 52% indicated that they have noticed Spanish messaging on signage in U. S. airports. Approximately 91% of participants also believe that Spanish messaging is a necessity in airports in the United States. These percentages could indicate that users look for bilingual signage in U. S. airports but

encounter systems that are not helpful, or do not encounter a bilingual signage system at all. It might also be the reason which can explain why only 43% of participants use the current messaging.

Further looking into the usefulness of the current bilingual signage systems, participants were asked their opinion regarding the helpfulness of messages in Spanish. Only thirteen (13) out of the thirty six (36) participants (36%) indicated they believe messages in Spanish in U. S. airports are very useful; followed by eight (8) participants (22%) who stated that they are sometime useful. The complete breakdown of participant opinions in this matter is illustrated in Table 2.

Table 2: Usefulness of Spanish Messaging on U. S. Airport Signage

Helpfulness	Response Percent
Very helpful	36%
Helpful most of the time	11%
Sometimes helpful	22%
Not very helpful	14%
Not helpful at all	6%
Other	11%

It is interesting to note, that about 45% of the participants found existing bilingual signage very useful, or useful most of the time, which correlates well with the percentage of participants who said they use Spanish messages on airport signage (45%).

The response percent regarding the quality of the Spanish messaging currently in place in U. S. airports was the biggest indicator as to why the Spanish speaking user utilizes the Spanish messages on bilingual airport signage much less than desired. Quality was defined for the participant as depending on factors such as legibility of the text, the ease of understanding the messages, the visibility of the sign in the environment, etc. When asked to share their opinions, eighteen (18) out of the thirty six (36) subjects (50%) said that quality of the Spanish messages currently in use on U.S.

bilingual signage is mediocre. These participants believe a lot of the translations used in the signage are sub par, illustrating the need to evaluate and come up with better Spanish translations, a need which is addressed in the second phase of experimentation of this thesis. They also indicated that some signage systems have grammatically incorrect translations and others use a copy size for the Spanish translation making them unreadable. The complete set of tabulated results can be found in Appendix C3.

Phase II

The on-line survey designed to identify the terms that participants noted as the best Spanish translation for primary airport functions was answered by sixty one (61) Spanish speakers from various nationalities and ages. It was necessary for the participants to understand the English terminology and be familiar with airport functions in Spanish in order to correctly answer the questions. Thus English proficiency and some experience in U. S. airports was a requirement for this group of participants.

The first part of the questionnaire tested the approved Spanish translations of airport functions which varied greatly among the selected sample of airports chosen not only because they currently have in place English-Spanish bilingual signage systems, but also because a large number of Spanish speaking users navigate them. These airports are Hartsfield-Jackson Atlanta International Airport, Houston Airport Systems, Miami International Airport and the Port Authority of New York and New Jersey Airports. For every term tested, the participants were asked to identify the variation they preferred, or considered more accurate over the other options presented. The results of this part of the survey can be separated into three categories based on the response percents of the tested terms. These categories are:

1. Strong user preference
2. Weak user preference

3. No user preference

Strong user preference

The participants identified a significant preference for one of the tested Spanish translations in half (8 out of 16) of the multiple choice questions. In each case, the percent response of the preferred translation was significantly higher than those of the other choices tested. This significance took into consideration that the number of translations to test for each term was not the same. For example, the term ***concourse*** had four possible Spanish translations with corresponding percent responses of 14%, 22%, 17% and 47%. This illustrates that almost half of the participant responses indicated option four (4) as the translation considered most correct, while the other half of responses were spread out quite evenly among the other three options, making option four (4) significantly preferred. The same way looking at the term ***gate,*** which only had two translations with response percents of 79% and 21% respectively, it is easy to see that choice one (1) was significantly preferred by the participants. The eight (8) terms and their response percentages are found below in Table 3.

Table 3: Response Percent in Order of Magnitude (1).

English Term	Response Percent			
	Highest	Second	Third	Fourth
Ticketing	57%	30%	13%	N/A
Parking	79%	11%	10%	N/A
Concourse	47%	22%	17%	14%
Gate	79%	21%	N/A	N/A
Connecting Flights	69%	31%	N/A	N/A
Restrooms	69%	28%	3%	N/A
Escalator	65%	22%	13%	N/A
Baggage Check-In	62%	25%	13%	N/A

The Spanish translations for these eight (8) airport terms with the highest response percent are recommended to be used in bilingual (English-Spanish) airport signage. They are found below in Table 4.

Table 4: Recommended Spanish terms with Strong User Preference

English Term	SpanishTranslation with highest response percent	Response Percent Highest
Ticketing	Venta de Boletos	58%
Parking	Estacionamiento	79%
Concourse	Salas de Embarque	47%
Gate	Puerta	79%
Connecting Flights	Vuelos de conexión	69%
Restrooms	Baños	69%
Escalator	Escalera eléctrica	65%
Baggage Chech-In	Registro de equipaje	62%

Weak user preference

Three (3) out of the sixteen (16) airport terms tested can be classified in this category, where even though the majority of participants indicated preference for a particular translation, a second option followed closely. The terms and their response percentages are found below in Table 5.

Table 5: Response Percent in Order of Magnitude (2).

English Term	Response Percent		
	Highest	Second	Third
Check-In	56%	33%	11%
Do Not Enter	54%	36%	10%
Ground Transportation	55%	38%	7%

The difference between the top two (2) response percents was not as significant as in the cases of terms having a strong user preference, making it harder to recommend the use of one term over the other. In this thesis, the translation with the higher response percent is strongly recommended, and the one that follows it is

recommended with reservations. It is important to remember that consistency is key when signing airport environments so that once a translation has been chosen to appear in a signage system the designer should adhere to it in order to avoid confusing the user. The Spanish translations recommended for these three (3) terms are shown in Table 6.

Table 6: Recommendations Based on Response Percent

English Term	Strongly Recommended	Recommended with Reservations
Check-In	Registro	Documentacion
Do Not Enter	Prohibido el Paso	No Entrar
Ground Transportation	Transporte Terrestre	Transporte Publico

No user preference

The remaining five (5) multiple choice questions to be addressed, fall under the no user preference category. The participants divided their preference into two of the options presented, creating a fifty (50) – fifty (50) split. The terms and their response percentages are found in Table 7.

Table 7: Response Percent in Order of Magnitude (3).

English Term	Response Percent		
	Highest	Second	Third
Rental Car	51%	44%	5%
Rental Car Return	52%	43%	5%
Men	51%	49%	N/A
Women	52%	48%	N/A
Elevator	51%	49%	N/A

After closer examination it became apparent that the translations being tested are synonym words commonly and interchangeably used in every day language. From this result it can be inferred that using either synonym as the Spanish translation in a

signage system would be considered correct, and understood by the user. The terms and the synonym translations are shown in Table 8.

Table 8: Synonym Translations

English Term	Translation 1	Translation 2
Rental Car	Alquiler de vehículos	Alquiler de automoviles
Rental Car Return	Devolución de vehículos alquilados	Devolución de automóviles alquilados
Men	Caballeros	Hombres
Women	Damas	Mujeres
Elevator	Ascensor	Elevador

It is also important to mention that relationships between these terms exist. The terms ***rental car*** and ***rental car return*** are used to identify separate areas of the same airport function, creating a need for terminology consistency once again. The Spanish translations of these two terms differ only in the word being used to translate ***car***, therefore if the translation ***vehículo*** is chosen, it should be used in the translation of both terms.

Similarly, it is customary to pair ***men – women*** or ***gentlemen – ladies***. The translations for these terms also adhere to that rule in the form of ***hombres - mujeres*** and ***caballeros – damas.*** The use of one word from the pair automatically implies the use of the other. It would be incorrect and even humorous for the user to see ***hombres*** paired with ***damas***, or ***caballeros*** paired with ***mujeres***.

The second half of the survey was designed to test the terms that were translated the same way in all of the airports included in this research by asking participants whether they agreed with the current translation or not. If they didn't agree, they were asked to propose a translation that in their opinion describes the term better.

Out of eleven (11) terms tested, only three (3) were identified by passengers as terms that could be better translated. The disagreement with the translations was

not overwhelming, but it was enough to warrant a closer look to the alternative translations proposed by the participants. From these participant proposed terms alternative choices surfaced. The researcher tallied the number of times a term was proposed by a participant this way identifying a user preferred term. Table 9 shows the eleven (11) tested translations and their percent agreement and disagreement.

Table 9: Percent Agreement / Disagreement with Current Translations.

English Term	Current translation	Percent in agreement	Percent in disagreement
Departing flights	Vuelos que parten	33%	67%
Departures	Salidas	97%	3%
Arriving Flights	Vuelos que llegan	53%	47%
Arrivals	Llegadas	98%	2%
US Customs & Border Protection	Aduana y Proteccion Fronteriza	88%	12%
Baggage Carts	Carros para Equipaje	90%	10%
City Train	Tren de Ciudad	52%	48%
Shuttles	Autobus	92%	8%
Hotel Shuttles	Autobuses de los Hoteles	77%	23%
Airport Shuttle	Autobus del Aeropuerto	88%	12%
Ferry	Barco	92%	8%

The terms the participants disagreed with, their current translations, and the proposed translations are shown in Table 10.

Table 10: Proposed Translations based on Participant Suggestions.

English Term	Current translation	Propposed translation
Departing flights	Vuelos que parten	Vuelos de Salida
Arriving Flights	Vuelos que llegan	Vuelos de Llegada
City Train	Tren de Ciudad	Tren Urbano

An interesting observation made during data analysis suggests that the phrasing of the term in English can sometimes have very strong impact on the translation into Spanish. For example, the terms ***departures*** and ***arrivals***, are used to describe the same airport function as the terms ***departing flights*** and ***arriving flights***. However, a direct translation for ***Departures*** and ***arrivals*** is much more natural and intuitive than

that for ***departing flights*** and ***arriving flights***. The approval rate for ***salidas*** and ***llegadas***, the respective translations for ***departures*** and ***arrivals*** was over 96% each.

The complete results for the phase II survey, including all the response percentages and counts, can be found in Appendix E2.

Phase III:

The experiment involved thirty eight (38) participants in total. Their performance in the experiment and their feedback helped the researcher identify the graphic standards and the Spanish message position on the sign that seem to be more useful for Spanish speaking airport users.

The participants made very few mistakes when choosing directions from the sample signs on the slides. Only a total of twenty nine (29) mistakes were tallied out of the 1140 total data points, but it became quickly apparent that more mistakes were made on five (5) specific slides out of the thirty (30) created for the experiment. These slides were number 1, 15, 16, 27, and 29, which are shown in Figure 13.

Figure 12: Experiment Slides where Participants Made Mistakes.

Figure 13: Continues.

Once the slides were identified, two similarities were found between them, which made the signs presented in each slide hard to use by the intended user. A closer look into these similarities led the researcher to recommend against these specific layout features and graphic standards for bilingual signage. These similarities are:

- Four (4) out of the five (5) signs on the slides had the Spanish translations located on a separate area of the sign away from the international symbol and the English message.
- The color used for the Spanish messages was the same as the color used for the English message (white).

From these observations it can be inferred that the signs in which the Spanish translation is located away from the English message and the international symbol are more difficult to understand by the Spanish speaking user. In the feedback session it was mentioned that the layout in question is especially problematic because it becomes more difficult for the user to relate the international symbol with the translation, loosing the quick reference visual clues that the symbols provide.

The lack of color differentiation between English and Spanish messages also seems to make the sign more difficult to understand for the Spanish speaker. Participants of the experiment expressed their difficulty in quickly picking out the Spanish message when all the text was in the same color (white), especially, when all the text was the same size. They stated that they found themselves trying to read all the messages, instead of automatically jumping to the Spanish.

In addition, during the debriefing session where feedback was given to the researcher regarding the signage just shown, the subjects were encouraged to keep in mind the differences between the signs and to comment on what made them easier or more difficult to understand and follow. These comments were collected and studied in order to synthesize a list of key recurring observations. The observations repeated the most are listed below in weighted order. The comment made most frequently is located at the top of the list, then the next most frequent comment, and so on.

- When the Spanish translation is located separate from the primary message it appears as if it were some other type of information, like regulatory information, rather than a translation.
- The Spanish translation in a different color helps identifying it quicker.
- The Spanish message with the same copy height as the primary (English) message is easier to understand, as long as they are a different color.

- Having the Spanish message and the primary message in different colors is more important than having them in different sizes.

The comments regarding color differentiation were made the most often. The great majority of participants stated that they liked being able to recognize the Spanish message with just a glance. They confirmed that after seeing two or three sings following this pattern, and recognizing that the Spanish language would appear in a different color (grey), they automatically looked for the color cutting down the time and effort in finding the desired Spanish message.

More participants seemed to dislike having Spanish translations in a smaller size than the primary message. They stated that the primary language in a bigger font makes finding the Spanish translation more difficult because the larger copy height of the primary message (English) draws the eye into it. The participants favored signs where the primary message and the Spanish translation were the same size, but a different color. It seems the color differentiation is more helpful for the Spanish speaking user than a difference in size.

Another interesting point that became apparent to the researcher is the existence of a learning curve. The participants needed less and less time to find the Spanish message the more familiar they became with the signage. This occurrence was observed by the researcher while monitoring the experiment sessions. In the fist few slides the participants took almost all the seven (7) seconds allocated to find the correct translation and note the correct direction on their answer sheets, but as the experiment continued and the participants were exposed to more and more signs, their response time decreased substantially. It is important to mention that the researcher did not time this occurrence, but that the decrease in response time was obvious to the naked eye.

It was also mentioned more than once, that the three-directional signs shown in the experiment can be confusing, especially when the arrows point up-and-to-the-left (10 o'clock) and up-and-to-the-right (2 o'clock). It is recommended not to use these types of arrows unless it is absolutely necessary.

Some of the subjects pointed out that they tend to read the middle panel first, if the term they were looking for was not there, then they would look to one side panel and lastly to the other. This is a known scanning technique: Looking for desired information first in the center, then the corners and lastly the rest of a space. Further investigation in this regard may be of interest to signage designers or human factors researchers, but it is beyond the scope of this thesis.

The complete experiment tally and all the user comments can be referenced in Appendix E4.

CONCLUSIONS AND RECOMMENDATIONS

Introduction

English-Spanish bilingual signage exists for one purpose – to provide the Spanish speaking user with a simple, understandable tool that helps him/her to navigate the maze-like facilities of U. S. airports. The following conclusions, based on the analysis experiment results enable the formulation of specific recommendations for the design of bilingual signage in U. S. airports.

Conclusion 1

The first phase of experimentation was designed to understand the user's perspective regarding English-Spanish bilingual airport signage. The hypothesis statement that was formulated to drive this phase was:

> **English-Spanish bilingual airport signage currently in use in US airports is perceived by the Spanish speaker users as a necessity, but its current design and content is not perceived as useful by the users.**

After interpreting the results from the survey utilized to gather Spanish speaker's opinions, this hypothesis was proven true. The analysis of results showed that even though Spanish speaking airport users think Spanish messages are necessary to navigate U. S. airport environments, they believe that the signage currently in place lacks Spanish message quality and is not very useful. The survey participants identified the following signage features as areas of improvement for this type of signage: translations, Anglicisms, grammatical errors, copy size and message placement.

Conclusion 2

Inconsistencies in the translations of airport terminology into Spanish became apparent when collecting approved translation list from airports currently implementing English-Spanish bilingual signage for the second phase of research, which attempted to propose solutions to alleviate the lack of standards in airport terminology in Spanish. Based on the analysis of experiment results created for this phase of research, it is possible to conclude that a consolidated list of recommended translations was created to be used as a guide for the design of English-Spanish bilingual signage. In turn hypothesis #2 was thus supported:

> **There are Spanish translations of airport terminology that are favored over alternate translations by a majority of Spanish speakers. A consolidated list of recommended translations favored by user preference can be produced.**

It is important to mention that although it is possible to recommend specific translations for the tested airport terminology, some of the terms have alternate translations which are also correct. Using these alternate Spanish translations is not strongly recommended due to their lower participant response percentages. Furthermore, other terms were found to have two translations that are equally preferred by Spanish speaking users. In this case, they are equally recommended as long as they are applied consistently on the signage system.

Table 11 shows the compiled list of Spanish translations created. The translations are organized in columns according to their designations as strongly recommended, recommended with reservation, or equally recommended. The eleven (11) terms originally found to be consistent in all the approved translation lists have been included at the bottom of the table for completion.

Table 11: Recommended Spanish Translations.

English Term	Strongly recommended	Recommended with reservation	Equally recommended
Airport Shuttle	Autobus del Aeropuerto		
Arrivals	Llegadas		
Arriving Flights	Vuelos que llegan	Vuelos de Llegada	
Baggage Carts	Carros para Equipaje		
Baggage Chech-In	Registro de equipaje		
Check-In	Registro	Documentación	
City Train	Tren de Ciudad	Tren Urbano	
Concourse	Salas de Embarque		
Connecting Flights	Vuelos de conexión		
Departing flights	Vuelos que parten	Vuelos de Salida	
Departures	Salidas		
Do Not Enter	Prohibido el Paso	No Entrar	
Elevator	Ascensor		Elevador
Escalator	Escalera eléctrica		
Ferry	Barco		
Gate	Puerta		
Ground Transportation	Transporte Terrestre	Transporte Público	
Hotel Shuttles	Autobuses de los Hoteles		
Men	Caballeros		Hombres
Parking	Estacionamiento		
Rental Car	Alquiler de vehículos		Alquiler de automóviles
Rental Car Return	Devolución de vehículos alquilados		Devolución de automóviles alquilados
Restrooms	Baños		
Shuttles	Autobus		
Ticketing	Venta de Boletos		
US Customs & Border Protection	Aduana y Protección Fronteriza		
Women	Damas		Mujeres
Agriculture*	Agricultura		
Cashier*	Caja		
Customs*	Aduana		
Destination*	Destino		
Domestic Arrivals*	Llegadas Nacionales		
Exit*	Salida		
Fight Information*	Información de Vuelo		
Immigration*	Inmigración		
International Arrivals*	Llegadas Internacionales		
Stairs*	Escaleras		
Terminal*	Terminal		

** Terminology found consistent in the approved translation lists. Not tested in this study.*

Conclusion 3

Analysis of phase III experiment results provided insight into the user preference on graphic standards and Spanish message placement supporting hypothesis # 3. This hypothesis states the following:

> **There exists a combination of graphic standards and message placement perceived to be more useful over other similar combinations by the Spanish speaking user.**

From the experiment results and the comments gathered during the debriefing session that followed each session, it became evident that Spanish speaking users favor a bilingual signage layout in which the Spanish translation is placed in proximity to the primary message and the international symbol. They also favor Spanish translations that have the same copy height as the primary message but are differentiated from the rest of the text by the uses of color.

The following recommendations for the design of bilingual (English-Spanish) airport signage are based on the above mentioned user preferences:

- Use color to differentiate the primary message from the Spanish translations. Selection of the color scheme should be mindful of the limitations of colorblind users.
- Keep the primary message and the Spanish translation the same copy height whenever possible, making sure to differentiate between them by the use of color.
- If it is necessary to reduce the copy size of the Spanish translation, keep the color differentiation between the translation and the primary message.
- Place the Spanish translation underneath the primary message, close to the international symbol allowing for easier reference.

Final Remarks

This thesis was motivated by a real and on-going challenge faced by the environmental graphic design community. A rigorous approach at formulating this problem and investigating its solution was undertaken. Driven by the research questions of this work hypotheses were generated and tested via structured experiments. Results of these experiments were consequently analyzed, providing valuable insight into the problem at hand and supporting all hypotheses.

As a result this thesis' contribution to the field is in the form of specific recommendations for the design and implementation of bilingual (English-Spanish) signage in U. S. Airports compatible with current signage standards.

Future work should build upon the recommendations from this thesis, and expand to include other bilingual signage challenges such as multilingual signage (more than two languages in the same sign), and specific bilingual combinations, particularly those that are known to be problematic (e.g. Chinese-English, Arabic-English). Other future work should also explore the challenges of bilingual signage in environments other than airports where navigation is also known to be a cognitively intense task (e.g. hospitals, convention centers).

APPENDIX A: Guidelines for Airport Signing and Graphics

** Appendices A1- A6 are excerpts from the Guidelines for Airport Signing and Graphics: Terminals and Landside by Erhart (2001).*

A1. Airport functions to be addressed by a comprehensive signage plan (Erhart 2001).

1. Vehicular Traffic

- Roadway ingress & egress
- Ticketing/Check-In
- Baggage Claim
- Rental Car Return
- Parking facilities
- Buss and taxi routes
- Service routes
- Remote facilities

2. Pedestrian Traffic

A. Departing Passengers

- Terminals
- Ticketing/Check-In
- Security
- Concourses/Gates
- Flight Information
- Concessions
- Directories
- Restrooms
- Telephones
- Emergency exits

B. Arriving Passengers

- Terminals
- Baggage Claim
- Fight Information
- Connecting flights
- Rental Cars
- Parking
- Concessions
- Restrooms
- Telephones
- Passenger Pick-up
- Customs/Immigration
- Currency Exchange
- Ground Transportation
- Emergency exits

3. Airport Operations (back of the house)

- Airport authority executive and operational offices
- Airline executive and operational offices
- Government, security, police offices, first aid
- Maintenance facilities
- Fuel Storage
- Ramp services
- Cargo services
- Baggage handling
- Advertising
- Other support facilities
- Emergency exits

A2. Standard Terminology

The following terminology guidelines are firmly requested and suggested as standards for a uniform national airport signage program (Erhart 2001).

1. Airport Trailblazer and Airport Entrance

The single word AIRPORT with its logo and/or letter code is recommended. The name of the airport is not necessary, unless the extreme proximity of another airport may cause confusion. Furthermore, the aviation symbol for Air Carrier Airport should be used in conjunction with the word AIRPORT, if display space permits.

It should be noted that the symbol for Non-Air-Carrier Airport varies from the standard symbol from airports served by passenger carrying airlines. If there is such an airport nearby, trailblazer and entrance signs should clearly indicate which airport is for passenger service.

2. Terminal Area Roadways

All structures used for aircraft arrivals and departures should use the word TERMINAL. More than one terminal will be denoted by an identifier such as TERMINAL 1, TERMINAL 2, 3, 4, and so on, in order that the roadway system has the passenger approach the facility, such as:

Compass references (i.e., North, South, East and West) are discouraged due to the fact that most users are not sufficiently oriented to discern true magnetic directions. Additionally, do not use names of individuals, or airline names, as the sole or primary terminal identifier. These designations augment confusion when a listing of airlines, operating from specific terminal buildings, is required.

In large complexes, many buildings, connectors, functions, and activities can bring about design schemes that are confusing to the public. A "systems analysis" may reveal building / area identifiers that could either be eliminated or treated as secondary, supplemental messages to streamline terminal nomenclature.

For separate roadway passenger pickup (arriving) functions, display the words BAGGAGE CLAIM as the primary message. ARRIVING FLIGHTS is a supplemental term that can be applied as a secondary message, particularly if required by the sponsor and designer for additional clarification.

For separate roadway drop off (departing) functions, employ TICKETING / CHECK-IN as the primary message. DEPARTING FLIGHTS is one more term that could serve as a secondary message, if required by the sponsor and designer for additional clarification.

To identify all areas where rented vehicles are to be returned, use the words RENTAL CAR RETURN. It the names of rental car companies are required by the sign system design, then use the standard airport letter style, not the individual corporate identity unless this will enhance the overall information system and is necessary for the passenger information process.

To locate the parking facility for the general public, use the word PARKING. To identify specific parking lots, use the following terms:

- HOURLY – for short periods of time, less than 24 hours.
- DAILY – for periods of 24 hours or more.
- REMOTE / SATELLITE – for outlying daily lots, Park & Ride, etc.
- VALET – for assisted parking.
- METERED – for coin operated spaces.
- GARAGE – which can then be separated into Hourly or Daily, as appropriate.

If parking lots or garages are related to multi-terminal complexes, use the term PARKING – TERMINAL 1, PARKING – TERMINAL 2, and so on.

- CARGO or SERVICE AREA – then term for all types of air freight, air forwarders, air express, air couriers, express mail, etc. that are usually found at remote freight/cargo facilities.

- AIRPOT EXIT – the term for exiting vehicular traffic.

- RETURN TO TERMINAL – the term for vehicular traffic leaving the terminal ticketing/check-in, baggage claim, or other areas from which they may need to return to the terminal.

3. Terminal Building Identification

As discussed earlier, the word TERMINAL is to be used for the passenger / aircraft building. The following terms are also acceptable for specific types or functions of terminals:

- INTERNATIONAL TERMINAL
- DOMESTIC TERMINAL
- COMMUTER TERMINAL

Areas within the terminal should be denoted by the following terms:

- TERMINAL – refers to the main building, exclusive of gate areas; generally, the non-secure areas located landside of security.

- BAGGAGE CLAIM – for the area where passengers claim their luggage from an arriving flight.

- GROUND TRANSPORTATION or GROUND TRANSPORT – all types of vehicular transportation for the general public.

- PARKING – this is the general term until the appropriate location presents itself to be more specific for passenger exiting the building.
- RESTROOMS – for the location of both MEN and WOMEN restroom/toilet facilities. The term should be combined with the appropriate aviation symbol. The term MEN should be used with the aviation symbol that corresponds to male restrooms, and the term WOMAN should be used with the aviation symbol that corresponds to female restrooms. The international symbol of accessibility should be used when appropriate.

- INFORMATION – this term is for general airport information along with the aviation symbol for information.

- TELEPHONE – this term is for telephone services in the terminal complex. Where appropriate, use the aviation symbol in addition to the word. Where appropriate, use the TTD symbol.

- CONCOURSE – this term is desirable instead of finger, pier, connector, satellite, bay, annex, etc. in order to represent the extension of the terminal building which contains boarding gates.

- GATE 0 designating the assigned passenger assembly area on a concourse or in the terminal building to board a departing flight.

The terms TERMINAL, CONCOURSE, and GATE differentiate each airport functional design. Some basic guidelines are as follows:

- For single terminal airports with no COUNCORSES identify GATES by continuous numbers.

- For single terminal airports with more than one COUNCOURSE, denote each COUNCURSE by alpha indicators starting with "A". The GATES should be indicated by alpha/numeric indicators, for example A1, A2, A3, or B1, B2, B3, etc. Note: it is not necessary to display the term GATE at each gate location.

- For multi-terminal airports with combination COUNCOURSES and separate TERMINALS, distinguish the TERMINALS by number, the COUNCOURSES by alpha indicators, and the GATES by alpha numeric indicators.

- When providing departing directional information on the terminal sign system to GATES, show the gate indicator as, for example: GATES 1 to 20, for a single terminal with no concourses and GATES A1 to A20, for multiple concourses. The word "to" or "To" is preferred between the specific gates shown, instead of the word "through" or "thru", or a hyphen.

The various terms for Entrance and Exit doorways are as follows:

- ENTER – use this term with or without an ARROW
- EXIT – use this term with or without an ARROW, depending on whether it is for general information or fire code compliance.
- DO NOT ENTER – This term is acceptable for both pedestrian and vehicular traffic. The corresponding aviation symbol should be employed with the words to reinforce the message.
- EMERGENCY EXIT – use where appropriate.

A3. Message Hierarchy

The following three lists categorize sign items into their primary, secondary, and tertiary classification with the terminal. It is important to understand that the same message may fall under a different category, depending upon where it is used (Erhart 2001).

1. **PRIMARY – Directional and Identification**
   This information should be the largest and most visible information on any sign face.

   - All directional information
   - Terminals
   - Ticketing / Check-In
   - Concourses
   - Gate identifiers
   - Information centers
   - Baggage Claim
   - Ground Transportation
   - Airline corporate identity at entrances, ticket counters, concourses, gates and baggage claim

2. **SECONDARY – Auxiliary services and support functions**
   This information supplements or reinforces information already transmitted by the primary message and signs.

   - Directories
   - Concessions
   - Types of ground transportation
   - Rental cars / Corporate identity
   - Parking
   - Flight Information Displays (FIDS)
   - Security points
   - Regulatory
   - Corporate identity (lounges, offices, and baggage services)
   - Restrooms
   - Telephones
   - Lockers
   - Police
   - First Aid

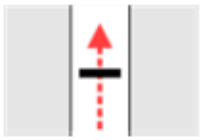
3. **TERTIARY – Third level information (Back of the house)**

   - Room numbers
   - Tenant names
   - Non-public (airline spaces)
   - Equipment labeling
   - Advertising
   - Employee information
   - Safety and hazard related signs

A4. Arrow Applications

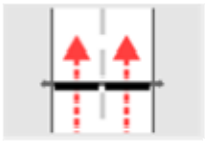
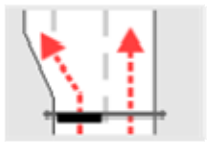
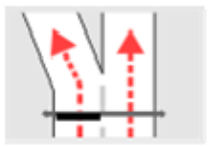
The following chart illustrates the correct application of standard arrows on directional pedestrian signage (Erhart 2001).

Interior Signs (Pedestrian) - **ALL Directionals**

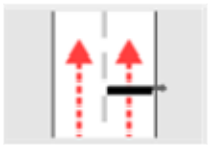
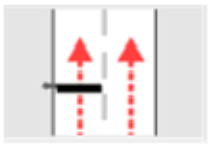
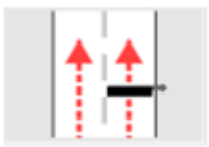
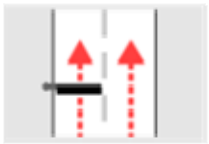
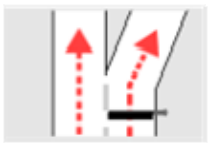
ARROW ORIENTATION	LOCATION PLAN EXAMPLE	INTERPRETATION	ARROW ORIENTATION	LOCATION PLAN EXAMPLE	INTERPRETATION
↑		Straight Ahead	→		Right
↑		Up	↘		Down or Right
↖		Ahead or Left	←		Left
↖		Up or Left	↙		Down or Left
↗		Ahead or Right	↓		Down
↗		Up or Right			

The following charts illustrate the correct application of standard arrows on directional vehicular signage (MUTCD 2003).

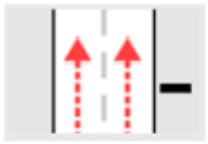
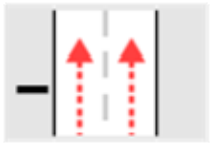
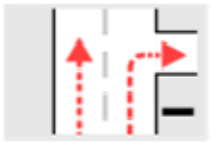
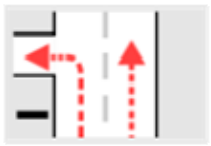
Signs (Vehicular) - OVERHEAD Directionals

ARROW ORIENTATION	LOCATION PLAN EXAMPLE	INTERPRETATION
↓		**Straight Ahead**
↘		**Ahead on Right**
↙		**Ahead on Left**
↗		**Up on Right**
↖		**Up on Left**

Signs (Vehicular) - CANTILEVERED Directionals

ARROW ORIENTATION	LOCATION PLAN EXAMPLE	INTERPRETATION
↑		**All Lanes Straight Ahead**
↑		**All Lanes Straight Ahead**
↓		**This Lane Only Straight Ahead**
↓		**This Lane Only Straight Ahead**
↖		**Ahead / Up on the Left**
↗		**Ahead / Up on the Right**

Signs (Vehicular) - ROADSIDE Directionals

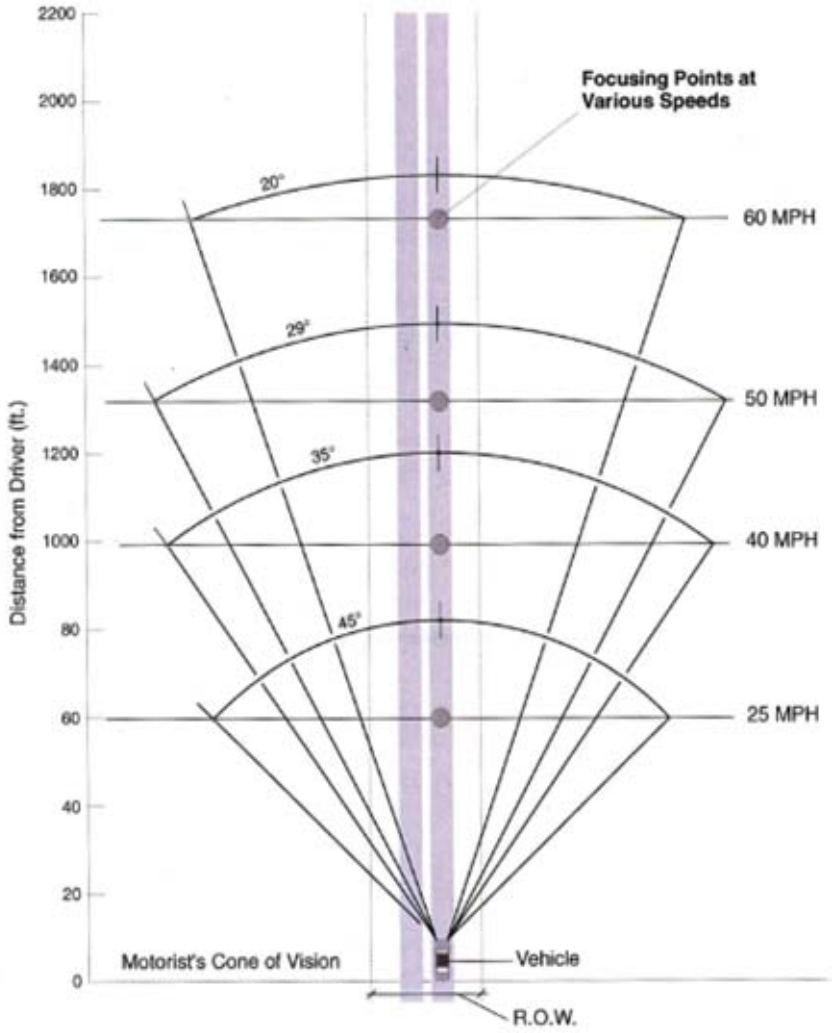
ARROW ORIENTATION	LOCATION PLAN EXAMPLE	INTERPRETATION
		**Straight Ahead**
		**Straight Ahead**
		**Ahead on Right**
		**To the Right**
		**Ahead on Left**
		**To the Left**

A5. International Symbol System

The most used symbols in today's airport signage systems is listed below (AIGA 2007):

A6. Viewing Distances and Copy Size for Motorists (Erhart 2001)

Basic Legibility Comparison					Total Area of Sign (Square Feet)	
SPEED (MPH)	NUMBER OF LANES	REACTION TIME (SECONDS)	DISTANCE TRAVELED DURING REACTION (FEET)	RECOMMENDED COPY HEIGHT (INCHES)	AIRPORTS COMMERCIAL INDUSTRIAL	OTHERS
15	2	8	176	4	8	6
30			352	7	25	18
45			528	10	50	36
55			704	14	100	70
15	4	10	220	4	8	6
30			440	9	40	28
45			660	13	90	64
55			880	17	150	106
15	6	11	242	5	13	10
30			484	9	140	28
45			726	14	100	70
55			968	19	190	134
55	Highway Interstate	12	1056	21	238	162



APPENDIX B: Hispanic Population Trends & Demographics

The data tabulations below were performed by Richard Fry. The statistical profile was designed and produced by Shirin Hakimzadeh. The tables are an excerpt from a statistical profile of the Latino population based on Pew Hispanic Center tabulations of the Census Bureau's 2005 American Community Survey, which was released August 29, 2006. This survey was fully implemented in 2005, and it became the largest household survey in the United States, with a sample of about 3 million addresses. It provides statistical resources not previously available except with data from a decennial census.

Pew Hispanic Center

Hispanics at Mid-Decade

Table 4. Nativity by Detailed Hispanic Origin: 2005

Universe: 2005 Hispanic Household Population

	Total	Native Born	Foreign Born	Percent foreign born
Mexican	26,784,268	15,928,209	10,856,059	40.5
Puerto Rican	3,794,776	3,754,043	40,733	1.1
Cuban	1,462,593	568,691	893,902	61.1
Dominican	1,135,756	463,374	672,382	59.2
Costa Rican	111,978	34,801	77,177	68.9
Guatemalan	780,191	228,767	551,424	70.7
Honduran	466,843	134,626	332,217	71.2
Nicaraguan	275,126	85,582	189,544	68.9
Panamanian	141,286	66,900	74,386	52.6
Salvadoran	1,240,031	389,051	850,980	68.6
Other Central American	99,422	33,909	65,513	65.9
Argentinean	189,303	48,023	141,280	74.6
Bolivian	68,649	22,530	46,119	67.2
Chilean	105,141	32,606	72,535	69.0
Colombian	723,596	217,149	506,447	70.0
Ecuadorian	432,068	130,926	301,142	69.7
Paraguayan	14,204	4,242	9,962	70.1
Peruvian	415,352	105,826	309,526	74.5
Uruguayan	51,646	8,027	43,619	84.5
Venezuelan	162,762	40,619	122,143	75.0
Other South American	75,239	25,734	49,505	65.8
Spaniard	362,424	303,154	59,270	16.4
All Other Spanish/Hispanic/Latino	3,033,648	2,458,739	574,909	19.0
Total	41,926,302	25,085,528	16,840,774	40.2

Source: Pew Hispanic Center tabulations of 2005 American Community Survey

Pew Hispanic Center

Hispanics at Mid-Decade

Table 10. Hispanic Population by State: 2000 and 2005

Universe: 2000 and 2005 Hispanic Household Population

	2005	2000	Change 2000-2005	Percent change 2000-2005
California	12,534,628	10,741,711	1,792,917	16.7
Texas	7,882,254	6,530,459	1,351,795	20.7
Florida	3,433,355	2,623,787	809,568	30.9
New York	3,026,286	2,782,504	243,782	8.8
Illinois	1,807,908	1,509,763	298,145	19.7
Arizona	1,679,116	1,267,777	411,339	32.4
New Jersey	1,312,326	1,098,209	214,117	19.5
Colorado	895,176	718,956	176,220	24.5
New Mexico	827,940	746,555	81,385	10.9
Georgia	625,382	425,305	200,077	47.0
Nevada	557,370	389,336	168,034	43.2
Washington	546,209	434,747	111,462	25.6
North Carolina	544,470	367,390	177,080	48.2
Massachusetts	489,662	412,496	77,166	18.7
Pennsylvania	488,144	381,159	106,985	28.1
Virginia	440,988	324,314	116,674	36.0
Michigan	378,232	318,285	59,947	18.8
Connecticut	372,718	309,798	62,920	20.3
Oregon	360,000	267,017	92,983	34.8
Maryland	311,191	227,586	83,605	36.7
Indiana	273,004	210,189	62,815	29.9
Utah	264,010	197,315	66,695	33.8
Ohio	253,014	212,007	41,007	19.3
Wisconsin	230,715	187,205	43,510	23.2
Oklahoma	218,987	168,944	50,043	29.6
Kansas	218,244	182,827	35,417	19.4
Minnesota	185,464	139,259	46,205	33.2
Tennessee	171,890	113,610	58,280	51.3
Missouri	154,744	114,741	40,003	34.9
South Carolina	136,616	90,263	46,353	51.4
Idaho	135,733	97,765	37,968	38.8
Arkansas	130,328	82,155	48,173	58.6
Louisiana	126,856	107,541	19,315	18.0
Nebraska	124,504	90,881	33,623	37.0
Rhode Island	114,077	87,454	26,623	30.4
Hawaii	103,764	84,471	19,293	22.8
Iowa	102,047	77,968	24,079	30.9
Alabama	98,624	70,305	28,319	40.3
Kentucky	65,177	53,002	12,175	23.0
Delaware	50,007	37,185	12,822	34.5

Pew Hispanic Center

Hispanics at Mid-Decade

Table 10 cont. Hispanic Population by State: 2000 and 2005

Universe: 2000 and 2005 Household Population

	2005	2000	Change 2000-2005	Percent change 2000-2005
Mississippi	48,795	34,543	14,252	41.3
District of Columbia	43,856	42,913	943	2.2
Wyoming	36,722	28,769	7,953	27.6
Alaska	29,219	23,992	5,227	21.8
New Hampshire	24,248	20,740	3,508	16.9
Montana	21,970	18,113	3,857	21.3
Maine	12,407	10,074	2,333	23.2
South Dakota	12,311	9,399	2,912	31.0
North Dakota	11,380	7,020	4,360	62.1
West Virginia	9,760	12,310	-2,550	-20.7
Vermont	4,474	4,687	-213	-4.5
Total	41,926,302	34,494,801	7,431,501	21.5

Source: Pew Hispanic Center tabulations of 2000 Census and 2005 American Community Survey

Pew Hispanic Center

Hispanics at Mid-Decade

Table 12. Hispanic Population by State: 2005

Universe: 2005 Household Population

	Hispanic Population	Total Population	Percent Hispanic
New Mexico	827,940	1,886,789	43.9
California	12,534,628	35,340,566	35.5
Texas	7,882,254	22,250,152	35.4
Arizona	1,679,116	5,806,266	28.9
Nevada	557,370	2,376,017	23.5
Florida	3,433,355	17,363,653	19.8
Colorado	895,176	4,540,639	19.7
New York	3,026,286	18,679,211	16.2
New Jersey	1,312,326	8,524,868	15.4
Illinois	1,807,908	12,441,864	14.5
Connecticut	372,718	3,365,768	11.1
Rhode Island	114,077	1,033,284	11.0
Utah	264,010	2,452,149	10.8
Oregon	360,000	3,560,922	10.1
Idaho	135,733	1,408,650	9.6
Washington	546,209	6,157,786	8.9
District of Columbia	43,856	508,572	8.6
Hawaii	103,764	1,258,528	8.2
Kansas	218,244	2,669,699	8.2
Massachusetts	489,662	6,200,944	7.9
Wyoming	36,722	494,170	7.4
Nebraska	124,504	1,706,343	7.3
Georgia	625,382	8,811,648	7.1
North Carolina	544,470	8,397,785	6.5
Oklahoma	218,987	3,429,974	6.4
Delaware	50,007	825,598	6.1
Virginia	440,988	7,320,848	6.0
Maryland	311,191	5,453,441	5.7
Arkansas	130,328	2,694,665	4.8
Indiana	273,004	6,081,212	4.5
Alaska	29,219	658,002	4.4
Wisconsin	230,715	5,401,740	4.3
Pennsylvania	488,144	11,948,862	4.1
Michigan	378,232	9,857,477	3.8
Minnesota	185,464	4,969,152	3.7
Iowa	102,047	2,848,266	3.6
South Carolina	136,616	4,127,391	3.3
Tennessee	171,890	5,816,359	3.0
Louisiana	126,856	4,387,181	2.9
Missouri	154,744	5,632,603	2.7

Pew Hispanic Center

Hispanics at Mid-Decade

Table 12 cont. Hispanic Population by State: 2005

Universe: 2005 Household Population

	Hispanic Population	Total Population	Percent Hispanic
Montana	21,970	897,367	2.4
Ohio	253,014	11,146,050	2.3
Alabama	98,624	4,448,075	2.2
New Hampshire	24,248	1,271,897	1.9
North Dakota	11,380	621,063	1.8
Mississippi	48,795	2,830,388	1.7
South Dakota	12,311	755,152	1.6
Kentucky	65,177	4,065,635	1.6
Maine	12,407	1,282,474	1.0
Vermont	4,474	609,857	0.7
West Virginia	9,760	1,781,817	0.5
Total	41,926,302	288,398,819	14.5

Source: Pew Hispanic Center tabulations of 2005 American Community Survey

APPENDIX C: Compilation of Spanish Translations

The following chart is a compilation of Spanish messaging obtained from the following airports in the United States (noted in alphabetical order):

- Hartsfield-Jackson Atlanta International Airport (ATL)
- John F. Kennedy International Airport (JFK)
- Houston William P. Hobby Airport (HOU)
- Miami International Airport (MIA)

The above mentioned airports are a sample of US airports which currently count with bilingual (English-Spanish) signage systems. The compilation of Spanish terms was created as part of the Literature review concerning this Thesis research study.

Standard Terminology in Engish	ATL Translations	Houston Airport System: IAH and HOU Translations	MIA Translations	Port Authority of NY & NJ Airpots Translations
Agriculture	Agricultura	Agricultura	Agricultura	Agricultura
All Passengers				
All Gates				Todas las Puertas
Arrivals	Llegadas	Llegadas		Llegadas
Baggage Claim	Reclamo de Equipaje	Reclamo de Equipaje	Reclamo de Equipaje	Reclamacion de Equipaje
Cargo		Carga		Carga
Check-in	Mostrador para documentacion			Facturacion
Connecting Flights	Vuelos de connexion		Vuelos que conectan	Vuelos en conexion
Central Baggage Claim			Reclamo Central de Equipaje	
Customs	Aduana	Aduana	Aduana	Aduana
Departing		Salida		
Departures		Salidas		Salidas
Destination	Destino	Destino	Destino	Destino
Domestic Arrivals	Llegadas Nacionales	Llegadas Nacionales	Llegadas Nacionales	Llegadas Nacionales
Domestic Flights		Vuelos Nacionales		
Do Not Enter	No Entrar	Prohibido El Paso	Prohibido pasar	No Pasar
Economy Parking		Estacionamientos Economico		Aparcamiento Economico
Elevator to	Elevador hacia	Elevador a	Ascensor	Elevador a
Escalator to		Escalera Electrica a:	Escalera Mecanica	Escaleras Automaticas
Exit	Salida	Salida	Salida	Salida
Flight		Vuelo		Vuelo
Flight Information	Informacion de Vuelo	Informacion de Vuelo	Informacion de Vuelo	Informacion de vuelo
Gates	Salas	Salas		Puertas
Ground Transport	Transporte Terrestre	Transportacion Terrestre	Transporte Urbano	Transporte por tierra
Immigration	Inmigracion	Inmigracion	Inmigracion	Inmigracion
Inter-Terminal Train		Tren Inter-Terminales		
International Arrivals	Llegadas Internacionales	Llegadas Internacionales	Llegada vuelos Internacionales	Llegadas Internacionales
Mail		Correos		Buzon de correos
No Entry		Prohibido El Paso		No Pasar
North Baggage Claim	Reclamo de Equipaje Norte		Reclamo Norte de Equipaje	
Parking	Estacionamiento	Estacionamiento	Parqueo	Aparcamiento
Parking Areas		Estacionamientos		
Passenger Drop-Off				Bajada de pasajeros
Passenger Pick-Up				Recogida de pasajeros
Passport control	Control de Pasaporte			

Standard Terminology in Engish	ATL Translations	Houston Airport System: IAH and HOU Translations	MIA Translations	Port Authority of NY & NJ Airpots Translations
Remarks		Observaciones		
Rental Cars		Alquileres de coches	Coche de la Renta	Alquiler de vehiculos
Restrooms	Baños		Lavatorios	
Ground Transportation		Transportacion Terrestre		Transporte por tierra
Security Checkpoint	Control de Seguidad			Control de Seguridad
Service Center [CO]		Centro de Servicio		
Solicitors		Solicitantes		
South Baggage Claim	Reclamo de Equipaje Sur		Reclamo Sur de Equipaje	
Stairs	Escalera	Escaleras	Escaleras	Escaleras
Terminal	Terminal	Terminal	Terminal	Terminal
Ticketing	Emision de Boletos	Venta de Boletos	Venta de Boletos	Venta de Billetes
Ticketing/Check-In		Venta de Boletos		Venta de Billetes y Facturacion
Train to	Tren hacia			
U. S. Customs		Aduana		Aduanas
Watch for Your Airline		Busque Su Aerolinea		
Watch Your Step		Cuidado con su paso		
Welcome	Bienvenido			
FIS, Terminal D:				
Baggage Check-In	Documentacion de equipaje	Chequeo de Equipaje		Facturacion de Equipaje
Baggage Re-Check	Redocumentacion de equipaje			
Cashier	Caja	Caja	Caja	Caja
Connecting Baggage		Equipaje para vuelos con conexiones		
FIDS				
Carrier		Aerolinea		Compañia
Flt		Vuelo		Vuelo
From		Desde		Desde
Gate		Sala		Puerta
Remark		Estatus		
Time		Hora		Hora

The following table contains the airport terms whose translations were consistent across the translation list of the airports researched.

Standard Terminology in Engish	ATL Translations	Houston Airport System: IAH and HOU Translations	MIA Translations	Port Authority of NY & NJ Airpots Translations
Agriculture	Agricultura	Agricultura	Agricultura	Agricultura
Customs	Aduana	Aduana	Aduana	Aduana
Destination	Destino	Destino	Destino	Destino
Domestic Arrivals	Llegadas Nacionales	Llegadas Nacionales	Llegadas Nacionales	Llegadas Nacionales
Exit	Salida	Salida	Salida	Salida
Flight Information	Informacion de Vuelo	Informacion de Vuelo	Informacion de Vuelo	Informacion de vuelo
Immigration	Inmigracion	Inmigracion	Inmigracion	Inmigracion
International Arrivals	Llegadas Internacionales	Llegadas Internacionales	Llegada vuelos Internacionales	Llegadas Internacionales
Stairs	Escalera	Escaleras	Escaleras	Escaleras
Terminal	Terminal	Terminal	Terminal	Terminal
Cashier	Caja	Caja	Caja	Caja

APPENDIX D: Phase I – Setup and Results

D1. Questionnaire #1 – English Version

The purpose of this questionnaire is to learn about the attitudes of individuals whose primary language is Spanish towards Bilingual (English-Spanish) Signage Systems in airports. The survey is being conducted by Alejandra Garcia-Castro, graduate student in the Master of Industrial Design program at the Georgia Institute of Technology as part of her Masters Thesis research. Your assistance in answering the questions below would be very much appreciated. **This survey is anonymous and confidential.**

---

1. How many times a year do you travel by airplane?
   [ ] none (0)
   [ ] sporadic (1 or 2)
   [ ] a few (3 to 5)
   [ ] frequent (6 or more)

2. What methods/means do you use when you need help finding your way through airports?
   [ ] Signs
   [ ] Asking airport/security personnel
   [ ] Asking an other passenger
   [ ] Other_____

3. What are the typical airport areas/facilities you use/visit at the airport? (bathroom, restaurants, etc)

   _____

4. Have you noticed Spanish text on signs in some airports in the United States? (This question does **NOT** refer to advertisements).
   [ ] No
   [ ] Yes

5. When you travel through airports in the United States do you use/read the Spanish text on airport signs that have messages in Spanish?
   [ ] No
   [ ] Yes

6. Do you think airport signs need Spanish text accompanying English text/directions?
   [ ] No
   [ ] Yes

7. For which airport functions would it be useful/necessary to have Spanish text on the airport signs? (For example: ticketing, exit, bathroom)

   _____

8. In your experience, messages in Spanish at airports in the United States are:
   [ ] very helpful
   [ ] helpful most of the time
   [ ] sometimes helpful
   [ ] not very helpful
   [ ] not helpful at all

9. The quality of a sign depends on factors such as the legibility of the text, the easy of understanding the messages, the visibility of the sign in the environment, etc. In your experience, how do you rate the Spanish messaging of airport signs you have encountered?
   [ ] Excellent
   [ ] Good
   [ ] OK
   [ ] Poor
   [ ] Very poor

10. Please describe your experiences navigating through airports you are **NOT** familiar with:

    _____

11. Imagine you are traveling through an airport in the United States. For each option/statement below, please indicate whether it makes you feel:
    Very Anxious (**VA**), Anxious (**A**), Somewhat Anxious (**SA**), or Not Anxious (**NA**)

	VA	**A**	**SA**	**NA**
An Airport you have never been in before	[ ]	[ ]	[ ]	[ ]
An Airport that only has English text on signs	[ ]	[ ]	[ ]	[ ]
An Airport that has English-Spanish text on signs	[ ]	[ ]	[ ]	[ ]

12. Do you have any additional comments regarding Spanish text on airport signage:

    _____

13. What is your highest level of schooling?
    [ ] elementary School
    [ ] middle School
    [ ] high School
    [ ] some college
    [ ] college graduate
    [ ] graduate school

14. What is your age:_____

15. Would you be willing to further help in this research by participating in a design exercise?
    [ ] Yes, tell me more.
    Contact information: _____

    [ ] No thank you.

Thank you very much for your time and your help.
Sincerely,

Alejandra Garcia-Castro

D2. Questionnaire #1– Spanish Version

El propósito de este cuestionario es estudiar las actitudes de individuos quienes hablan español como su primera lengua hacia los sistemas de señalamiento bilingües (inglés-español) en los aeropuertos de los Estados Unidos. Este estudio esta siendo conducido por Alejandra García-Castro, estudiante de Maestría en diseño industrial el programa de diseño industrial en el Georgia Insitute of Technology (Gerogia Tech) como parte de su investigación de Tesis. Se le agradece de antemano su asistencia respondiendo las siguientes preguntas. **Este cuestionario es completamente anónimo.**

---

1. ¿Cuantas veces por año viaja por avión?
   [ ] Ninguna (0)
   [ ] Esporádicamente (1 o 2)
   [ ] Unas cuantas (3 a 5)
   [ ] Frecuentemente (6 o mas)

2. ¿Que métodos/recursos utiliza cuando necesita ayuda encontrando su camino dentro de aeropuertos?
   [ ] Señales o letreros
   [ ] Pedir hayuda a un oficial/empleado del aeropuerto
   [ ] Preguntar a otro pasajero
   [ ] Otro _____

3. ¿Cuales son las áreas que visita normalmente en los aeropuertos? (baños, restaurantes, etc.)

   _____

4. ¿Ha notado mensajes en español en los sistmas de señalamiento de algunos aeropuertos de Estados Unidos? (Esta pregunta **NO** se refiere a avisos, anuncios o letreros publicitarios).
   [ ] Si
   [ ] No

5. Cuando viaja en los Estados Unidos, ¿Utiliza/lee los mensajes en español en los de los aeropuertos que cuentan con sistemas de señalamientos en Español?
   [ ] Si
   [ ] No

6. ¿Cree usted que los señalamientos en aeropuertos de los Estados Unidos deben llevar mensajes en español ademas de mensajes en inglés?
   [ ] Si
   [ ] No

7. ¿Para qué areas/servicios de los aeropuertos cree usted que son útiles/necesarios avisos de señalaminto escritos en español? (Por ejemplo: Reclamo de equipaje, baños, salas de abordaje, etc.)

   _____

8. En su experiencia, los mensajes en español dentro de aeropuertos en los Estados Unidos son:
   [ ] muy útiles
   [ ] útiles
   [ ] a veces útiles
   [ ] no muy útiles
   [ ] nada útiles

9. LA calidad de un avizo de señalaminto depende de factores como la facilidad para leer el texto del aviso, la facilidad para entender el mensaje/las direcciones, la facilidad para notar/encontral el aviso, etc. Basándose en su experiencia, por favor califique la calidad de los mensajes en español de los aeropuetos en los Estados Unidos.
   [ ] Excelentes
   [ ] Buenos
   [ ] Regulares
   [ ] Malos
   [ ] Muy malos

10. Por favor describa sus experiencias viajando a través de aeropuertos que usted no conoce:

    _____

11. Imagine que esta viajando a traves de un aeropuerto en los Estados Unidos. Para cada una de las siguientes opciones/situaciones, por favor indique si se siente: Muy Ansioso (**MA**), Ansioso (**A**), Algo Ansioso (**AA**), o Nada Ansioso (**NA**)

	MA	**A**	**AA**	**NA**
Es un aeropuerto por el cual usted nunca ha viajado	[ ]	[ ]	[ ]	[ ]
Es un aeropuerto en el que solamente hay mensajes en inglés en los letreros	[ ]	[ ]	[ ]	[ ]
Es un aeropuerto en el que hay mensajes en inglés y en español en los letreros	[ ]	[ ]	[ ]	[ ]

12. ¿Tiene usted algún otro comentario a cerca de señalamientos con mensajes en español en los aeropuertos de los Estado Unidos?

    _____

13. ¿Cuál es su nivel de educación?
    [ ] primaria
    [ ] secundaria
    [ ] bachillerato
    [ ] preparatoria
    [ ] universidad (incompleta)
    [ ] universidad (completa)
    [ ] estudios post-universitarios (diplomado, Maestrial, Doctoradpo)

14. ¿Cuál es su edad? _____

15. ¿Estaría usted dispuesto a participar en un ejercicio de diseño contribuyendo así a la segunda etapa de investigación de este estudio?
    [ ] Si, déme mas informacion.
    Manera de contactarle (teléfono o email): _____

    [ ] No gracias

Muchas gracias por su tiempo y ayuda.

Atentamente,
Alejandra García-Castro

D3. Results

1. How many times a year do you travel by airplane?

answer options	answer options - Spanish	Response Percent	Response Count
None(0)	Ninguna (0)	0.00%	0
Sporadic (1 or 2)	Esporádicamente (1 o 2)	41.67%	15
A few (3 to 5)	Unas cuantas (3 a 5)	27.78%	10
Frequent(6 or more)	Frecuentemente (6 o mas)	30.56%	11
	answered question		36
	skipped question		7

2. What methods/means do you use when you need help finding your way through airports?

answer options	answer options - Spanish	Response Percent	Response Count
Signs	Señales o letreros	94.44%	34
Asking airpot/security personnel	Pedir ayuda a un oficial/empleado del aeropuerto	38.89%	14
Asking another passenger	Preguntar a otro pasajero	5.56%	2
Other (describe please)	Otro (por favor describa)	5.56%	2
	answered question		36
	skipped question		7

3. What are the typical airport areas/facilities you use/visit at the airport? (bathroom, restaurants, etc)

answers	answers - Spanish	Response Percent	Response Count
bathrooms	baños	91.43%	32
imigracion	imigracion	5.71%	2
concesions	tiendas	45.71%	16
baggage claim	reclamo de equipaje	11.43%	4
aduanas	customs	5.71%	2
information screens-FIDS-(arrivlas and departures)	pantallas de informacion de vuelos	2.86%	1
arrivals lobby	lobby de llegadas	2.86%	1
boarding gates	salas de espera o abordaje	17.14%	6
Duty Free	duty free	2.86%	1
restaurants	restaurantes	57.14%	20
Airline Business Launges (Delta Crown.. Etc)	Salas de espera de las aerolineas	8.57%	3
ATM	cajero automatico	2.86%	1
Airline counter	mostrador de las aerolineas	2.86%	1
Ticketing	counters de registro	11.43%	4
Church	Iglesia	2.86%	1
Bar	bar	11.43%	4
Public transportation	transporte publico	2.86%	1
	answered question		35
	skipped question		8

4. Have you noticed Spanish text on signs in some airports in the United States? (This question does **NOT** refer to advertisements).

answer options	answer options - Spanish	Response Percent	Response Count
Yes	Si	52.78%	19
No	No	47.22%	17
	answered question		36
	skipped question		7

5. When you travel through airports in the United States do you use/read the Spanish text on airport signs that have messages in Spanish?

answer options	answer options - Spanish	Response Percent	Response Count
Yes	Si	42.86%	15
No	No	57.14%	20
		answered question	35
		skipped question	8

6. Do you think airport signs need Spanish text accompanying English text/directions?

answer options	answer options - Spanish	Response Percent	Response Count
Yes	Si	91.18%	31
No	No	8.82%	3
		answered question	34
		skipped question	9

7. For which airport functions would it be useful/necessary to have Spanish text on the airport signs? (For example: ticketing, exit, bathroom)

answers	answers - Spanish	Response Percent	Response Count
All airport functions	Todas las funciones aeropuertuarias	42.86%	15
Baggage Claim	Reclamo de equipaje	34.29%	12
Bathrooms	Baños	20.00%	7
Concourses / Gates	Salas y puertas de salida	28.57%	10
Information	Informacion	8.57%	3
Police / Security	Policia / Seguridad	8.57%	3
Immigration / Customs	Imigracion / Aduana	14.29%	5
ATM	Cajeros Automaticos	2.86%	1
Transportation	Transportacion	5.71%	2
Enter / Exit	Entradas / Salidas	5.71%	2
Restaurants / Food	Restaurantes / Comida	8.57%	3
Directional Signs	Letreros direccionales	5.71%	2
Handicapped Aid	Ayuda al minusvalido	2.86%	1
Customer Service	Servicio al cliente	2.86%	1
Concessions	Tiendas	2.86%	1
None	Ningun	2.86%	1
Ticketing / Check-In	Ventas de boletos / Registro	5.71%	2
Emergency routes	Rutas de emergencia	2.86%	1
		answered question	35
		skipped question	8

8. In your experience, messages in Spanish at airports in the United States are:

answer options	answer options - Spanish	Response Percent	Response Count
Very useful	Muy útiles	36.11%	13
Useful	Utiles	11.11%	4
Sometimes useful	A veces útiles	22.22%	8
Not very useful	No muy útiles	13.89%	5
Not useful	Nada útiles	5.56%	2
Other (describe please)	Otro (por favor describa)	11.11%	4
		answered question	36
		skipped question	7

9. The quality of a sign depends on factors such as the legibility of the text, the easy of understanding the messages, the visibility of the sign in the environment, etc. In your experience, how do you rate the Spanish messaging of airport signs you have encountered?

answer options	answer options - Spanish	Response Percent	Response Count
Excelent	Excelentes	2.78%	1
Good	Buenos	22.22%	8
Regular	Regulares	50.00%	18
Bad	Malos	8.33%	3
Very bad	Muy malos	8.33%	3
Other (describe please)	Otro (por favor describa)	8.33%	3
		answered question	36
		skipped question	7

10. Please describe your experiences navigating through airports you are **NOT** familiar with:

answered question	29
skipped question	14

Most Popular Responses Translated into English
Its frustrating. Not knowing the language is not only a problem when trying to read sing, but also when trying to ask someone for directions.
Its hard to get oriented. Big airports are Cleary more difficult to navigate, specially without signs to follow.
Airports are so hectic these days, that the experiences are usually negative.

11. Imagine you are traveling through an airport in the United States. For each option/statement below, please indicate whether it makes you feel:
Very Anxious (**VA**), Anxious (**A**), Somewhat Anxious (**SA**), or Not Anxious (**NA**)

answer options	answer options - Spanish	MA	A	AA	NA	Response Count
An airport you have never been in before	En un aeropuerto por el cual usted nunca ha viajado	5	5	21	4	35
An airport that only has English text on Signs	En un aeropuerto en el que solamente hay mensajes en inglés en los letreros	3	6	8	17	34
An Airport that has English-Spanish text on signs	En un aeropuerto en el que hay mensajes en inglés y en español en los letreros	0	0	7	28	35
					answered question	35
					skipped question	8

12. Do you have any additional comments regarding Spanish text on airport signage:

answered question	17
skipped question	26

Most Popular Responses Translated into English
Translations are typically terrible.They tend to be literal translations form English, which require the user to know the English word to figure out what the translation means.
translations were done by an individual who learned Spanish as a second language.
Spanish messaging is very important due to the increasing number of hispanics in the US, and the increase business with Latin America.
All airports that handle international travel, or are located in largely Hispanic areas need to have messages in Spanish

13. What is your highest level of schooling?

answer options	answer options - Spanish	Response Percent	Response Count
elementary school	primaria	0.00%	0
Middle school	secundaria	0.00%	0
High School	bachillerato	2.78%	1
	preparatoria	2.78%	1
University / College (Incomplete)	universidad (incompleta)	22.22%	8
University / College (Complete)	universidad (completa)	30.56%	11
Graduate School	estudios post-universitarios (diplomado, Maestria, Doctorado)	41.67%	15
		answered question	36
		skipped question	7

14. What is your age:_____

Respondents	Age
1	27
2	63
3	51
4	38
5	68
6	35
7	43
8	59
9	26
10	25
11	26
12	37
13	28
14	26
15	22
16	33
17	25
18	28
19	29
20	25
21	25
22	48
23	63
24	43
25	24
26	27
27	60
28	27
29	29
30	30
31	61
32	28
33	25
34	32
35	38
36	55
answered question	36
skipped question	7

Mean	36.91666667
Median	29.5
Mode	25

APPENDIX E: Phase II – Setup and Results

E1. Questionnaire #2

The purpose of this questionnaire is to identify the preferred Spanish translations for airport terminology. The survey is being conducted by Alejandra Garcia-Castro, graduate student in the Master of Industrial Design program at The Georgia Institute of Technology as part of her Masters Thesis research. Your assistance in answering the questionnaire will be appreciated. **This survey is anonymous and confidential.**

For the following airport functions, choose the Spanish translation that in your opinion **best** describes the English term. Choose only one translation per term.

1. TICKETING
   - [ ] Emisión de Boletos
   - [ ] Venta de Boletos
   - [ ] Venta de Billetes

2. CHECK-IN
   - [ ] Documentación
   - [ ] Facturación
   - [ ] Registro

3. RENTAL CAR
   - [ ] Alquiler de vehículos
   - [ ] Alquiler de automóviles
   - [ ] Alquiler de coches

4. RENTAL CAR RETURN
   - [ ] Devolución de vehículos alquilados
   - [ ] Devolución de automóviles alquilados
   - [ ] Devolución de coches alquilados

5. PARKING
   - [ ] Estacionamiento
   - [ ] Aparcamiento
   - [ ] Parqueo

6. CONCOURSE
   - [ ] Puertas de Salida
   - [ ] Puertas de Embarque
   - [ ] Salas de Salida
   - [ ] Salas de Embarque

7. GATE
   - [ ] Puerta
   - [ ] Sala

8. CONNECTING FLIGHTS
   - [ ] Vuelos de conexión
   - [ ] Vuelos en conexión

9. RESTROOMS
   - [ ] Baños
   - [ ] Sanitarios
   - [ ] Lavatorios

10. MEN
    - [ ] Hombres
    - [ ] Caballeros

11. WOMEN
    - [ ] Mujeres
    - [ ] Damas

12. DO NOT ENTER
    - [ ] No Entrar
    - [ ] No Pasar
    - [ ] Prohibido el Paso

13. ELEVATOR
    - [ ] Elevador
    - [ ] Ascensor

14. ESCALATOR
    - [ ] Escalera eléctrica
    - [ ] Escalera mecánica
    - [ ] Escalera automática

15. BAGGAGE CHECK-IN
    - [ ] Documentación de equipaje
    - [ ] Facturación de equipaje
    - [ ] Registro de equipaje

16. GROUND TRANSPORTATION
    - [ ] Transporte Terrestre
    - [ ] Transporte Urbano
    - [ ] Transporte Publico

Indicate whether you **agree** or **disagree** with the Spanish translation for the following terms of airport functions. If you disagree, please provide a suggestion of a correct translation.

17. DEPARTING FLIGHTS = Vuelos que parten
[ ] Agree
[ ] Disagree, my suggestion is: _____

18. DEPARTURES = Salidas
[ ] Agree
[ ] Disagree, my suggestion is: _____

19. ARRIVING FLIGHTS = Vuelos que llegan
[ ] Agree
[ ] Disagree, my suggestion is: _____

20. ARRIVALS = Llegadas
[ ] Agree
[ ] Disagree, my suggestion is: _____

21. US CUSTOMS & BORDER PROTECTION = Aduana y Protección Fronteriza
[ ] Agree
[ ] Disagree, my suggestion is: _____

22. BAGGAGE CARTS = Carros de Equipaje
[ ] Agree
[ ] Disagree, my suggestion is: _____

23. CITY TRAIN = Tren de Ciudad
[ ] Agree
[ ] Disagree, my suggestion is: _____

24. SHUTTLES = Autobús
[ ] Agree
[ ] Disagree, my suggestion is: _____

25. HOTEL SHUTTLES = Autobuses de los hoteles
[ ] Agree
[ ] Disagree, my suggestion is: _____

26. AIRPORT SHUTTLE = Autobús del Aeropuerto
[ ] Agree
[ ] Disagree, my suggestion is: _____

27. FERRY = Barco
[ ] Agree
[ ] Disagree, my suggestion is: _____

Thank you very much for your time and your help.
Sincerely,

Alejandra Garcia-Castro

E2. Results

Choose the Spanish translation that in your opinion **best** describes the English term.

1. TICKETING

answer options	Response Percent	Response Count
Emisión de Boletos	29.51%	18
Venta de Boletos	57.38%	35
Venta de Billetes	13.11%	8
answered question		61
skipped question		4

2. CHECK-IN

answer options	Response Percent	Response Count
Documentación	32.79%	20
Facturación	11.48%	7
Registro	55.74%	34
answered question		61
skipped question		4

3. RENTAL CAR

answer options	Response Percent	Response Count
Alquiler de vehículos	50.82%	31
Alquiler de automóviles	44.26%	27
Alquiler de coches	4.92%	3
answered question		61
skipped question		4

4. RENTAL CAR RETURN

answer options	Response Percent	Response Count
Devolución de vehículos alquilados	52.46%	32
Devolución de automóviles alquilados	42.62%	26
Devolución de coches alquilados	4.92%	3
answered question		61
skipped question		4

5. PARKING

answer options	Response Percent	Response Count
Estacionamiento	78.69%	48
Aparcamiento	9.84%	6
Parqueo	11.48%	7
answered question		61
skipped question		4

6. CONCOURSE

answer options	Response Percent	Response Count
Puertas de Salida	13.56%	8
Puertas de Embarque	22.03%	13
Salas de Salida	16.95%	10
Salas de Embarque	47.46%	28
answered question		59
skipped question		6

7. GATE

answer options	Response Percent	Response Count
Puerta	78.69%	48
Sala	21.31%	13
answered question		61
skipped question		4

8. CONNECTING FLIGHTS

answer options	Response Percent	Response Count
Vuelos de conexión	68.85%	42
Vuelos en conexión	31.15%	19
answered question		61
skipped question		4

9. RESTROOMS

answer options	Response Percent	Response Count
Baños	68.85%	42
Sanitarios	27.87%	17
Lavatorios	3.28%	2
answered question		61
skipped question		4

10. MEN

answer options	Response Percent	Response Count
Hombres	49.18%	30
Caballeros	50.82%	31
answered question		61
skipped question		4

11. WOMEN

answer options	Response Percent	Response Count
Mujeres	47.54%	29
Damas	52.46%	32
answered question		61
skipped question		4

12. DO NOT ENTER

answer options	Response Percent	Response Count
No Entrar	36.07%	22
No Pasar	9.84%	6
Prohibido el Paso	54.10%	33
answered question		61
skipped question		4

13. ELEVATOR

answer options	Response Percent	Response Count
Elevador	49.18%	30
Ascensor	50.82%	31
answered question		61
skipped question		4

14. ESCALATOR

answer options	Response Percent	Response Count
Escalera eléctrica	65.00%	39
Escalera mecánica	13.33%	8
Escalera automática	21.67%	13
answered question		60
skipped question		5

15. BAGGAGE CHECK-IN

answer options	Response Percent	Response Count
Documentación de equipaje	24.59%	15
Facturación de equipaje	13.11%	8
Registro de equipaje	62.30%	38
answered question		61
skipped question		4

16. GROUND TRANSPORTATION

answer options	Response Percent	Response Count
Transporte Terrestre	55.00%	33
Transporte Urbano	6.67%	4
Transporte Publico	38.33%	23
answered question		60
skipped question		5

Indicate whether you **agree** or **disagree** with the Spanish translation for the following terms of airport functions. If you disagree, please provide a suggestion of a correct translation.

17. DEPARTING FLIGHTS = Vuelos que parten

answer options	Response Percent	Response Count
Agree	32.76%	19
Disagree, my suggestion is:	67.24%	39
answered question		58
skipped question		7

Participant Suggestions	Tally
salida de vuelos	10
salidas	2
vuelos de salida	14
vuelos de partida	2
vuelos que estan de salida	1
vuelos que salen	3
vuelos-salidas	2
salen	1
vuelos a partir	1
vuelos salientes	2
vuelos a salir	1

18. DEPARTURES = Salidas

answer options	Response Percent	Response Count
Agree	96.61%	57
Disagree, my suggestion is:	3.39%	2
answered question		59
skipped question		6

19. ARRIVING FLIGHTS = Vuelos que llegan

answer options	Response Percent	Response Count
Agree	52.63%	30
Disagree, my suggestion is:	47.37%	27
answered question		57
skipped question		8

Participant Suggestions	Tally
Llegada de vuelo	10
Llegadas	2
Vuelos de llegada	13
Vuelos de entrada	1
Vuelos en llegada	1
vuelos a llegar	1
vuelos que llegan	1
arrivo de vuelos	1
vuelos arrivando	1
vuelos llegando	1

20. ARRIVALS = Llegadas

answer options	Response Percent	Response Count
Agree	98.31%	58
Disagree, my suggestion is:	1.69%	1
answered question		59
skipped question		6

21. US CUSTOMS & BORDER PROTECTION = Aduana y Protección Fronteriza

answer options	Response Percent	Response Count
Agree	88.14%	52
Disagree, my suggestion is:	11.86%	7
answered question		59
skipped question		6

22. BAGGAGE CARTS = Carros de Equipaje

answer options	Response Percent	Response Count
Agree	90.00%	54
Disagree, my suggestion is:	10.00%	6
answered question		60
skipped question		5

23. CITY TRAIN = Tren de Ciudad

answer options	Response Percent	Response Count
Agree	51.72%	30
Disagree, my suggestion is:	48.28%	28
answered question		58
skipped question		7

Participant Suggestions	Tally
Tren Urbano	10
Metro o Subterraneo	5
Tren a la ciudad	2
Tren de la ciudad	6
Tren de cercania	2
Tranvia	1
Tren de transporte	1
Tren Publico	1

24. SHUTTLES = Autobús

answer options	Response Percent	Response Count
Agree	91.67%	55
Disagree, my suggestion is:	8.33%	5
answered question		60
skipped question		5

25. HOTEL SHUTTLES = Autobuses de los hoteles

answer options	Response Percent	Response Count
Agree	76.67%	46
Disagree, my suggestion is:	23.33%	14
answered question		60
skipped question		5

26. AIRPORT SHUTTLE = Autobús del Aeropuerto

answer options	Response Percent	Response Count
Agree	88.33%	53
Disagree, my suggestion is:	11.67%	7
answered question		60
skipped question		5

27. FERRY = Barco

answer options	Response Percent	Response Count
Agree	91.53%	54
Disagree, my suggestion is:	8.47%	5
answered question		59
skipped question		6

APPENDIX F: Phase III – Setup and Results

F1. Sign Variations

1. Message copy size: 3”
   Message color: White
   Spanish translation copy size: 3”
   Spanish translation color: White
   Spanish translation placement: Directly below each message
   Color accents: None

2. Message copy size: 3”
   Message color: White
   Spanish translation copy size: 3”
   Spanish translation color: Grey
   Spanish translation placement: Directly below each message
   Color accents: None

3. Message copy size: 5”
   Message color: White
   Spanish translation copy size: 3”
   Spanish translation color: White
   Spanish translation placement: Directly below each message
   Color accents: None

4. Message copy size: 5”
   Message color: White
   Spanish translation copy size: 3”
   Spanish translation color: Grey
   Spanish translation placement: Directly below each message
   Color accents: None

5. Message copy size: 3”
   Message color: White
   Spanish translation copy size: 3”
   Spanish translation color: White
   Spanish translation placement: In separate translation panel at bottom of sign
   Color accents: None

6. Message copy size: 3”
   Message color: White
   Spanish translation copy size: 3”
   Spanish translation color: Grey
   Spanish translation placement: In separate translation panel at bottom of sign
   Color accents: None

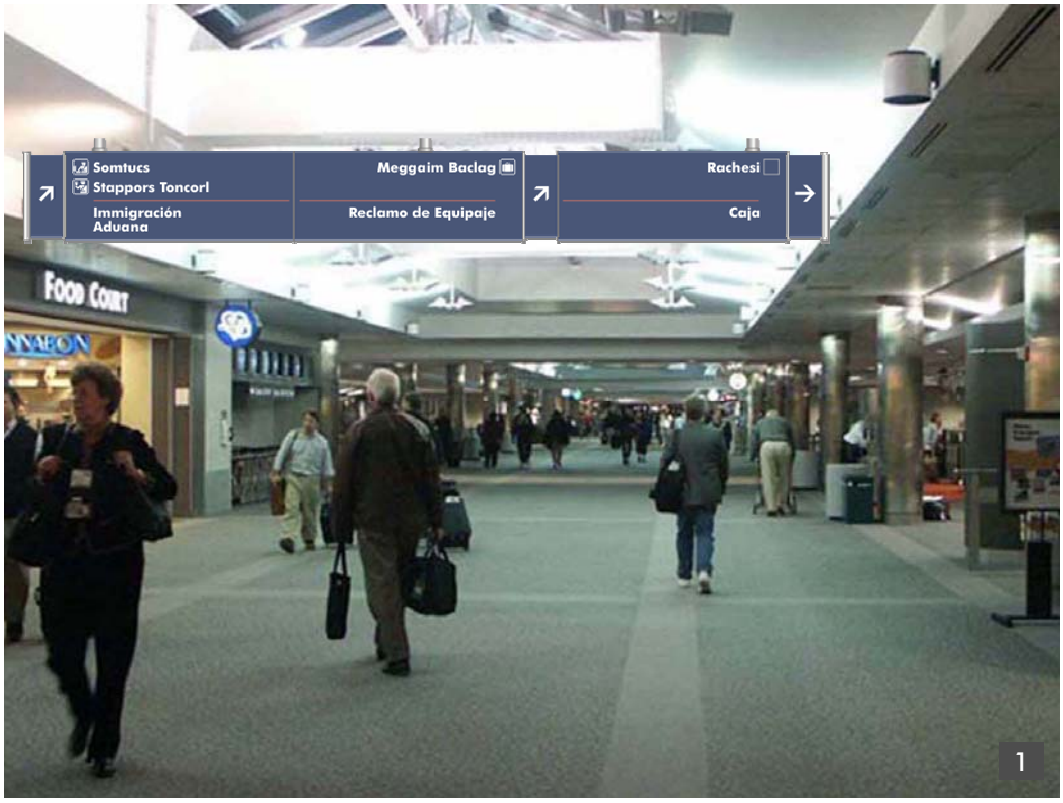
7. Message copy size: 3”
   Message color: White
   Spanish translation copy size: 3”
   Spanish translation color: White
   Spanish translation placement: In separate translation panel at bottom of sign
   Color accents: Orange separation line

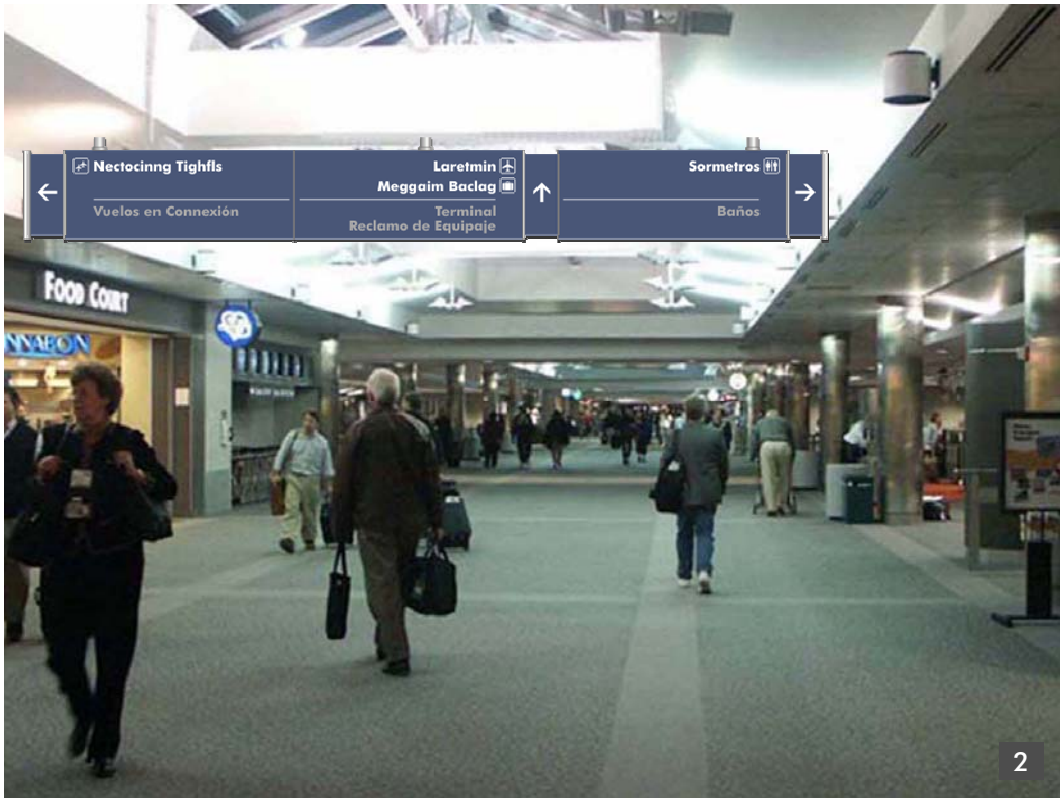
8. Message copy size: 5”
   Message color: White
   Spanish translation copy size: 3”
   Spanish translation color: White
   Spanish translation placement: In separate translation panel at bottom of sign
   Color accents: None

9. Message copy size: 5”
Message color: White
Spanish translation copy size: 3”
Spanish translation color: Grey
Spanish translation placement: In separate translation panel at bottom of sign
Color accents: None

10. Message copy size: 5”
Message color: White
Spanish translation copy size: 3”
Spanish translation color: White
Spanish translation placement: In separate translation panel at bottom of sign
Color accents: Orange separation line

F2. Experiment Slides






Ralavirs
Llegadas
Negtickti / Kenchic
Venta de Boletos / Registro
Laretmin D
Terminal D
Meggaim Baclag
Reclamo de Equipaje
FOOD COURT
3


Tages C1 - C20
Salas de C1- C20
Tages C21 - C36
Salas de C21- C36
Laretmin
Meggaim Baclag
Reclamo de Equipaje
Terminal
FOOD COURT
4


Negtickti / Kenchic
Venta de Boletos / Registro
Meggaim Baclag
Reclamo de Equipaje
Xite
Salida
Drogun Partnostr
Transporte Urbano
FOOD COURT

5


Yetrisc Chontipeck
Control de Seguridad
Meggaim Baclag
Reclamo de Equipaje
Nosecurcos A -D
Salas A - D
FOOD COURT

6


Sormetros
Baños
Somtucs
Stappors Toncorl
Imigración
Aduana
Nectocinng Tighfls
Meggaim Baclag
Vuelos en Connexión
Reclamo de Equipaje
FOOD COURT
7


Voletare
Elevador
Sormetros
Baños
Stappors Toncorl
Control de Pasaporte
Meggaim Baclag
Reclamo de Equipaje
Tages C19 - C32
Salas F1 - F10
FOOD COURT
8


Nosecurcos A,B,C
Salas de Embarque A,B,C
Meggaim Baclag
Reclamo de Equipaje
Nosecurcos D,E,F
Salas de Embarque D,E,F
FOOD COURT

9


Laretmin A
Meggaim Baclag
Terminal A
Reclamo de Equipaje A
Drogun Partnostr
Neltra Rac
Transporte Urbano
Alquiler de vehiculos
Laretmin C
Terminal C
FOOD COURT

10


Meggaim Baclag
Drogun Partnostr
Reclamo de Equipaje
Transporte Urbano
Semdotic Ralavirs
Llegadas domesticas
Semdotic Raterpudes
Salidas domesticas
FOOD COURT

11


Meggaim Baclag
Drogun Partnostr
Reclamo de Equipaje
Transporte Urbano
Semdotic Ralavirs
Llegadas Domesticas
Yetrisc Chontipeck
Nosecurcos
Control de Seguridad
Salas de Embarque
FOOD COURT

12


Nectocinng
Tighfls
Vuelos en Connexión
Laretmin
Meggaim Baclag
Terminal
Reclamo de Equipaje
Sormetros
Baños
FOOD COURT

13


Meggaim Baclag
Reclamo de Equipaje
Drogun Partnostr
Transporte Urbano
Semdotic Ralavirs
Llegadas domesticas
Semdotic Raterpudes
Salidas domesticas
FOOD COURT

14


Tages D1- D20
Salas D1- D20
Tages D21- D40
Salas D21- D40
Meggaim Baclag
Laretmin
Reclamo de Equipaje
Terminal
FOOD COURT

15


Yetrisc Chontipeck
Ralavirs
Control de Seguridad
Llegadas
Drogun Partnostr
Kragnip
Transporte Urbano
Estacionamiento
Meggaim Baclag
Reclamo de Equipaje
FOOD COURT

16


Tages B - C
Salas B, C
Yonem Haxcenge
Cambio de moneda
Meggaim Baclag
Reclamo de Equipaje
Tages A1 - A32
Salas A1 - A32
FOOD COURT

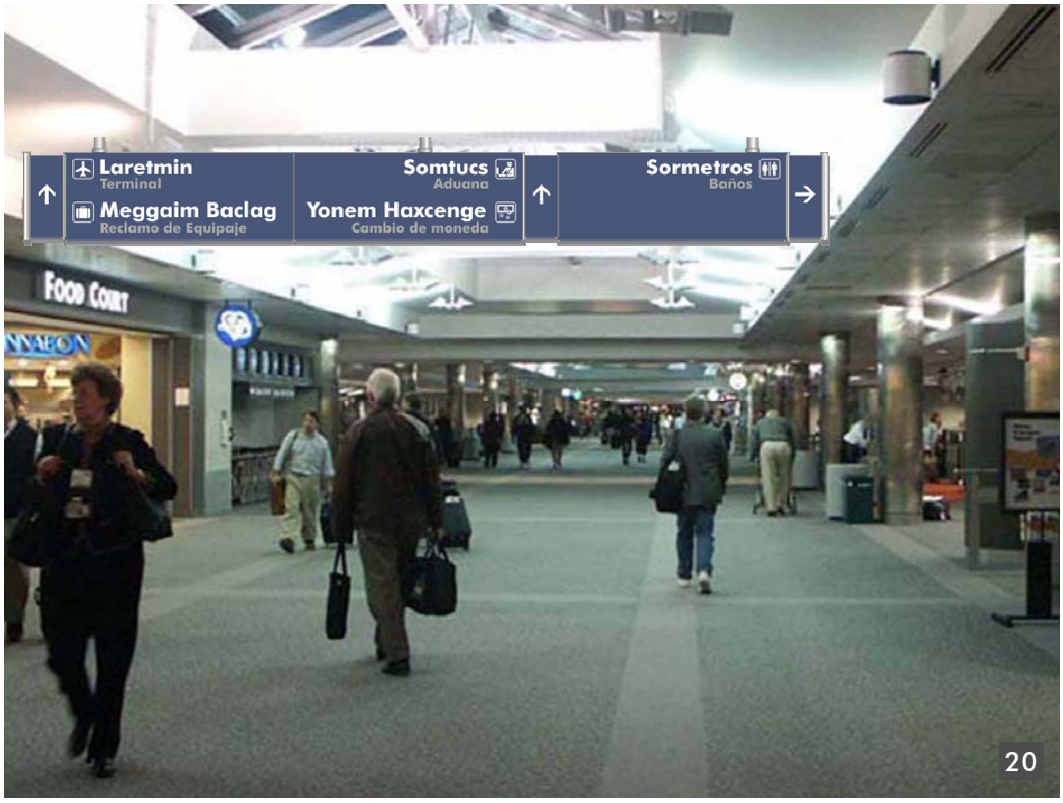
17


Laretmins A, B
Terminales A, B
Negtickti / Kenchic
Salas de Embarque C1- C20
Laretmin D
Terminal D
Stappors Toncorl
Control de Pasaporte
Meggaim Baclag
Reclamo de Equipaje
FOOD COURT

18


Laretmin
Terminal
Meggaim Baclag
Reclamo de Equipaje
Tages C1 - C18
Salas C1 - C18
Tages C19 - C32
Salas C19 - C32
Sormetros
Baños
FOOD COURT

19


Laretmin
Terminal
Meggaim Baclag
Reclamo de Equipaje
Somtucs
Aduana
Yonem Haxcenge
Cambio de moneda
Sormetros
Baños
FOOD COURT

20


Yetrisc Chontipeck 2
Nosecurcos A & B
Control de Seguridad 1
Salas A y B
Meggaim Baclag
Reclamo de Equipaje
Yetrisc Chontipeck 2
Nosecurcos C & D
Control de Seguridad 2
Salas C y D
FOOD COURT
21


Yetrisc Chontipeck
Ralavirs
Control de Seguridad
Llegadas
Drogun Partnostr
Kragnip
Transporte Urbano
Estacionamiento
Meggaim Baclag
Reclamo de Equipaje
FOOD COURT
22


Meggaim Baclag
Reclamo de Equipaje
Yetrisc Chontipeck
Control de Seguridad
Nosecurcos
Salas de Embarque
Negtickti
Venta de Boletos
FOOD COURT

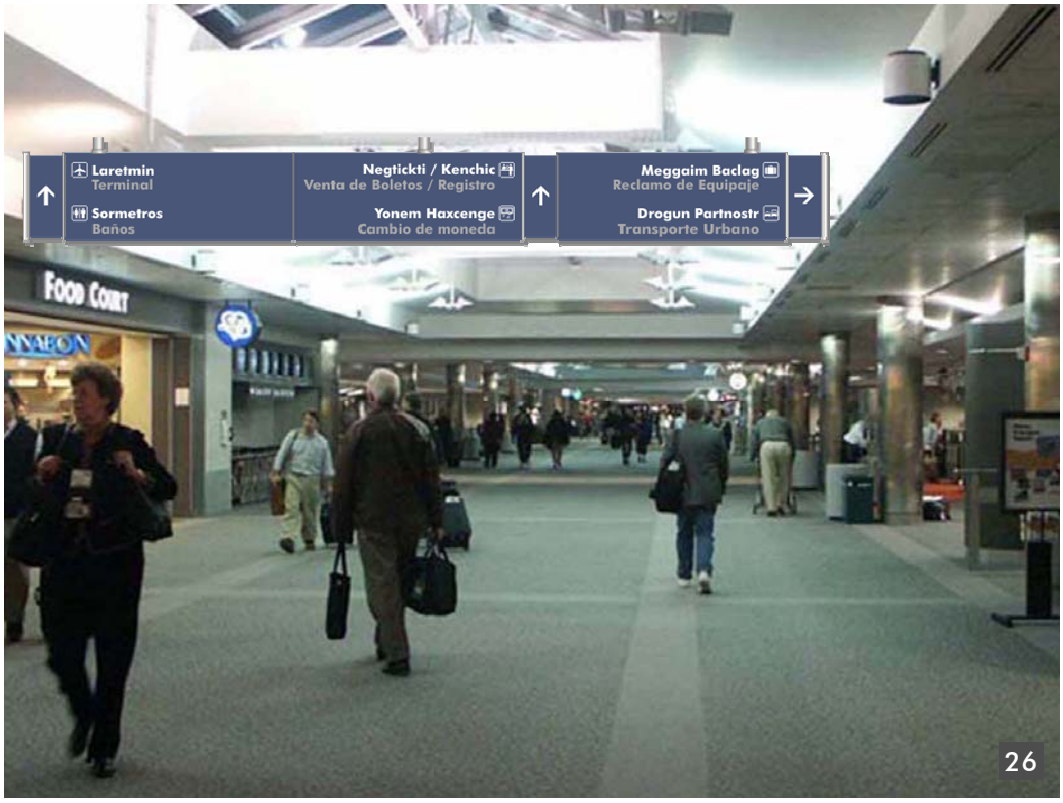
23


Laretmin A
Meggaim Baclag
Terminal A
Reclamo de Equipaje
Drogun Partnostr
Neltra Rac
Transporte Urbano
Alquiler de vehículos
Laretmin C
Terminal C
FOOD COURT

24


Etirnataniolan Ralavirs
Llegadas internacionales
Meggaim Baclag
Reclamo de Equipaje
Semdotic Ralavirs
Sormetros
Llegadas domesticas
Baños
FOOD COURT

25


Laretmin
Terminal
Sormetros
Baños
Negtickti / Kenchic
Venta de Boletos / Registro
Yonem Haxcenge
Cambio de moneda
Meggaim Baclag
Reclamo de Equipaje
Drogun Partnostr
Transporte Urbano
FOOD COURT

26


Laretmin Treno
Terminal Norte
Laretmin Necratl
Terminal Central
Neltra Rac
Alquiler de vehiculos
Meggaim Baclag
Reclamo de Equipaje
Drogun Partnostr
Transporte Urbano
FOOD COURT

27


Meggaim Baclag
Drogun Partnostr
Reclamo de Equipaje
Transporte Urbano
Etirnataniolan
Ralavirs
Llegadas internacionales
Etirnataniolan
Raterpudes
Salidas internacionales
FOOD COURT

28


Meggaim Baclag
Drogun Partnostr
Reclamo de Equipaje
Transporte Urbano
Semdotic Ralavirs
Llegadas Domesticas
Yetrisc Chontipeck
Nosecurcos
Control de Seguridad
Salas de Embarque
FOOD COURT
29


Etirnataniolan
Ralavirs
Llegadas Internacionales
Nectocinng
Tighfls
Vuelos en Connexión
Drogun Partnostr
Meggaim Baclag
Transporte Urbano
Reclamo de Equipaje
FOOD COURT
30

F3. Experiment Answer Sheet

1. Baggage Claim

2. Connecting Flights

3. Terminal D

4. Terminal

5. Exit

6. Concourses A and D

7. Customs

8. Restrooms

9. Baggage Claim

10. Rental Car

11. Ground Transportation

12. Domestic Departures

13. Connecting Flights

14. Domestic Arrivals

15. Baggage Claim

16. Arrivals

17. Money Exchange

18. Gates A1 – A32

19. Restrooms

20. Customs

21. Concourses C & D

22. Parking

23. Ticketing

24. Rental Car

25. International Arrivals

26. Ground Transportation

27. Central Terminal

28. International Arrivals

29. Concourses

30. Baggage Claim

Left	1
Up to Left	2
Straight	3
Up to Right	4
Right	5

Answ Key:	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5

Question Number

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	4	3	5	3	5	1	5	1	3	3		3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
2	4	3	5	3	5	1	5	1	3	3	3	3	1	**4**	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
3	**3**	3	5	3	5	1	5	1	3	3	3	3	1	**4**	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
4	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
5	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	**2**	**3**	5
6	4	3	**3**	**5**	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
7	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
8	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
9	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
10			5	3	5	1	5	**5**	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
11	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
12	**1**	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
13	4	3	5	3	5	1	5	1	3	3	3		1	3	**3**	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
14	4	3	5	3	5	1	**2**	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	**3**	5
15	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	**3**	3	1	3	5	3	5	5
16	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
17	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	**3**	5
18	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
19	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	**1**	3	4	5	3	4	3	4	3	1	3	5	3	5	5
20	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	**3**	3	5	5
21	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
22	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	**3**	3	5	5
23	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
24	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
25	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	**4**	3		5	3	4	3	4	3	1	3	5	3	5	5
26	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1		3	4	5	3	4	3	4	3	1	3		3	5	5
27	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
28	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
29	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
30	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
31	4	3	5	3	5	1	5	1	3	3	3	3	1	3	**3**	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
32	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
33	4	3	5	3	5	1	5	1	3	3	3	3	1	3	**3**	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
34	**3**	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
35	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3		3	5	5
36	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
37	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5
38	4	3	5	3	5	1	5	1	3	3	3	3	1	3	1	2	3	4	5	3	4	3	4	3	1	3	5	3	5	5

Total Erros:	4	1	1	1	0	0	1	1	0	0	1	1	0	2	3	3	0	1	0	0	0	0	1	0	0	0	4	1	3	0

Signs 1, 15, 16, 29 = Use a separate pannel for translations
Signs 27 = Translation under primary language
All of them have white ONLY font

Comments from Feedback session	Tally						Total
2 o'clock and 10 o'clock arrows are harder to undertand	1	1					3
Arrow pannel on left and arrow pointing to 2 or 3 o'clock is confusing							1
Translation right under is easier to find the Spanish	1	1					3
Translation right under = relates to symbol and Eng better	1						2
Separate pannel for translations easier to find spanish	1	1	1	1			5
Different color aids when finding Spanish on sign	1	1	1	1	1	1	7
Different color more important than diferent size	1	1	1				4
Bigger fonts (usually primary language) draw the eye in first, making finding the translation harder	1	1	1	1	1		6
Preference for different color and separate pannel - Eye does not bounce arround	1	1	1				4
Easiest to find translation when there is a difference in size and color	1						2
Easier to find translation when there is a difference in size							1
Different pannel harder to understand	1						2
Different pannel, different size is best							1
Different size aids							1
Different size make no difference	1	1					3
Separate pannel looks like something else, not a translation	1	1	1				4
Look at symbols first, then look at translations	1	1	1	1			5
Once realized the dif color is Span. Always look for it							1
Learning curve- learn the system move with it! - Idea of a good introductory sign - consistency							1
Symbols need to be bigger - need to dominate the signs	1						2
Personal preference to have all arrows on one side.. read left to right							1
Arrow pannel at center of sign instead of to the right							1
Read center pannel first then sides	1	1					3
Same size words easier to understand	1						2
Loose time when having to translate the terms from English to Spanish							1
Separate pannel… want lower pannel to have symbols again and another arrow… like another sign	1						2
Same color, same size, right under = bad / not enough visual distinction	1						2
Look for translations, then to symbol for confirmation	1						2
Separate arrow pannel useful							1
Same color better							1
Primnary language bigger when pop is 40 / 50 or less, but when close to 50 / 50 - same size							1

REFERENCES

AIGA (2007). Symbols Signs. New York, NY, The professional association for design. **2007**.

ADNET (2001). Census 2000: Hispanics in the U. S. A., MSO. **2007**.

Arthur, P. and R. Passini (1992). WAYFINDING: People, Signs, and Architecture. New York, N.Y., McGraw-Hill Book Company.

Bernstein, R. (2006). Census Bureau Releases Population Estimates by Race, Hispanic Origin and Age for States and Counties. Washington, DC, Census Bureau, Public Information Office. **2006**.

Cabanellas de las Cuevas, G. (2003). "Neutral Spanish: Is it Necessary? Does it Exist?" Proteus - National Association of Judiciary Interpreters and Translators **XII**(4).

Carpenter, E. (1989). ""Wayfinding: Design breackthrough or trendy buzzword?" Print **43**(1): 92-163.

Carter, P. M. (2005). American Varieties: Spanglish! - Spanish in the U. S., Macneil / Lehrer Productions. **2007**.

Delta (2007). Delta Stats & Facts. Atlanta, GA, Delta Airlines, Inc. **2007**.

Erhart, J. (2001). Guidelines for Airport Signing and Graphics: Terminals and Landside. Washington DC, Air Transport Association of America.

Erichsen, G. (2007). Varieties of Spanish, About Inc a part ot The New York Times Company.

Hakimzadeh, S. and R. Fry (2006). A statistical Portrait of Hispanics at Mid-Decade, Pew Hispanic Center. **2007**.

Kokotailo and Kline Congenital Colout Vision Deficiencies, University of Calgary, Department of Phychology, Vision & Aging Lab. . **2006**.

Neisser, U. (1967). Cognitive Psyschology. Englewood Cliffs, N.J., Prentice Hall.

Passini, R., G. Proulx, et al. (1990). "The spatio-cognitive abilities of the visual impaired population." Environment and Behavior **22**(1): 91-118.

Roberts, D. (2006). Group Manager, Environmental Graphics Design, Cater & Burgess, Inc. Atlanta, GA.

Sommer, R. and B. Sommer (2002). A Practical Guide to Behavioral Research: Tools and Techniques. New York, N. Y., Oxford University Press.

Suther, G. N. (1985). WAYFINDING IN AIRPORTS: IMAGE AND CLARITY. College of Architecture. Atlanta, GA, Georgia Institute of Technology.